ESSAYS ON LABOR MARKET INTERVENTIONS

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This dissertation analyzes the economic, political, and social consequences of labor market interventions by different economic actors. What happens when consumers in the developed world intervene in the labor market of the developing world through boycott campaigns? How did a Temporary Workers Protection Act mandated by the Korean government shape the relations between a temporary workers' union and a regular workers' union? Does increase in minimum wages decrease household poverty? In this dissertation, we will see that well-intended action may make the targeted individuals worse-off. We will also see that in some cases such backlashes can lead to other opportunities.

The first chapter "Boycott Activism and Its Welfare Consequences" provides a theoretical framework that can be used to analyze the overall effects of product boycotts. Consumers have the power to change the behavior of the firm through boycott campaigns. Their conscientious participation, however, may actually result in a reduction in welfare of the workers if the firm decides to alter its operation by lowering the wage expecting a demand decrease or by shutting down and moving elsewhere. The analysis emphasizes the importance of information, suggesting that activists set their goals by studying the labor market and coordinating with local groups rather than demanding what may seem righteous.

The second chapter "Solidarity or Competition? A Tale of Two Unions" presents a case study of a coalition of two labor unions that led the 2007 Tempo-

rary Workers Movement against the government's installment of a Temporary Workers Protection Act in South Korea. One union consisted mainly of regular workers and the other mainly of temporary workers. I argue that political opportunities combined with change in objectives with the progression of negotiation shaped the processes of coalition formation and dissolution. Qualitative and quantitative variance of resources, protest style, and membership characteristics across organizations acted as an incentive for joining forces at first, but hindered a common identity from forming and ultimately led to the breaking of the coalition.

The third chapter "Poverty Effects of the Minimum Wage: The Role of Household Employment Composition" (with Gary Fields and Ravi Kanbur) provides an analytical framework to study the impact of minimum wages on a class of absolute poverty measures. The effects of a minimum wage increase depend on the values of key parameters (poverty line, poverty aversion, labor demand elasticity, and the starting level of the minimum wage), which demonstrates a need for a nuanced appreciation of poverty measures. Moreover, the relationship between poverty and the minimum wage is in general non-monotonic, so that local effects may be different from the effects of large changes in the minimum wage.

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BIOGRAPHICAL SKETCH

Baran Han was born in Gwangju, Republic of Korea in 1981. She studied Physics at the Korea Advanced Institute of Science and Technology, Daejon, Korea. After many travels in college, she became interested in the issues of development and poverty and in 2003 entered the KDI School of Public Policy and Management in Seoul, Korea, to pursue a masters in public policy. In August 2004, she moved to Ithaca, NY to study economics. Employment problems - political, economic, and social - of low-wage earners and social activism have been her focus of research.

To my grandmother, Gil-soon Kim

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To the memory of Yolin Chen: if it were not for him I would be probably toiling myself in graduate school still studying physics - of course, it is hard to say whether it would have been for the better. I thank him for pushing me to see the world and giving me a chance to grow together.

My parents, Sunah Kim and Chongsoo Han, for their love, support, and trust throughout the process and for misleading me when I was little into thinking that getting a PhD was like getting a high school diploma. To my sisters Ahram and Ein, and my brother Changwoo for their love. I dedicate this dissertation to my maternal grandmother Gil-soon Kim, who raised me and took me to my first day of school 22 years ago - she has been with me every step since then.

And last but not least, to my 23-28 year old self for not giving up.

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CHAPTER 1

BOYCOTT ACTIVISM AND ITS WELFARE CONSEQUENCES

1.1 Introduction

The 1990s saw a surge of anti-sweatshop boycott campaigns against multinational corporations.[1] Activists demanded improvements in working conditions - higher wage rates, shorter working hours - at the respective subcontracting firms[2] by threatening to refrain from making selected purchases (Friedman, 1985, p. 97) if their requests were not met.

I present a general equilibrium framework that links consumers, the firm, and workers and analyze the welfare consequences of such boycott activism. I argue that as the firm decides on the price and quantity of goods to produce maximizing its profits given the minimum wage requests from the activists and the estimated product demand, consumers and workers may become better or worse off compared to the pre-boycott situation. The intuition is that when the price of a product increases in response to the increase in wages, and when there are many non-activists in the population who do not care about the welfare of the workers in the first place, the consumers overall may be worse off due to boycott campaigns. On the other hand, if product price decreases because of the campaign, consumers will be unambiguously better-off. For the workers, if the firm decides to ignore the threats and takes the hit of the demand shock and eventually reduce production, then there will be less employment available. Moreover, the firm may decide to move to a cheaper region so that even with

[1] For a review of the US's campaign, refer to Elliott and Freeman (2001).

[2] 100 percent of the goods sold by firms such as Nike and Reebok are manufactured in subcontracting firms all over the world.

the demand shock one may reap greater profits, or decide to move to a more expensive but productive location where the wage is justified by the productivity (Brown et al., 2002, p. 12) which in both cases will result in unemployment making the production workers worse off.[3]

There are some empirical evidence of firm exits: according to Kucera (2001) cited by Brown et al. (2002), a 10% increase in wage share was associated with a 6.6% to 8.5% decline in foreign direct investment inflows in the less developed countries, compared with a 4.3% to 5.8% decline for all countries. Harrison and Scorse (2006) have found that in Indonesia, from 1990 to 1996, the anti-sweatshop activism resulted in more than 20% increase in real wages for unskilled workers in large foreign-owned textiles, footwear, and apparel (TFA) exporting plants relative to other TFA plants that were not exposed to activism. They found a large increase in aggregate manufacturing unemployment, even though there was not a significant additional impact to the employments of the firms that were exposed to activism. Interestingly, foreign-owned TFA exporting plants were less likely to close down during those periods.

This is not the first paper to model boycotts. For example, Basu and Zarghamee (2005) looks at how consumer product boycotts based on product labelling may increase child labor: children are less desired by the firm which will lower the wage and therefore forcing them to work more for the household to reach subsistence level of income. Another paper that looks at how boycott works is Baron (2002): he demonstrates how individuals may appear to coor-

[3]Unfortunately, sometimes the firm exits were not adverse side effects of a well-intended action but were the goals themselves. As Moran (2002, p. 70) points out, there has been individuals who criticized the working conditions in developing countries in order to protect the jobs in the developed world. By imposing higher standards in the low-productivity low-wage locations they force the firms not to off-shore in such regions in the first place or to exit and relocate back home, to the high-wage high-productivity region.

dinate actions to boycott against a firm and explores why such actions occur quickly for certain issues than others.

To the best of my knowledge, there has not been any work that looks at overall welfare effects of boycott activism. When the existing boycott models are essentially partial equilibrium frameworks that focus on either the labor side or the consumption side, the general equilibrium setting provided in this paper allows us to analyze the impact on boycotts to the overall society - consumers, workers, the firm - so that one can work out the optimal minimum wage that gives us the first-best outcome. This paper is also the first work that I know of which explicitly models footloose firms: when will the firm exit and what can the activists do to prevent it are some questions that I try to answer.

I have a three-period model that captures the dynamics between the boycott activists and the firm. In period 1, firm decides between two possible regions of production: a low productivity and low wage region, and a high productivity and high wage region.[4] In period 2, consumers obtain information about the welfare of the workers that produce the goods they consume. The activists declare a minimum wage level and threatens the firm: "If you, the firm, do not raise the wage level to $\hat{w}$, we will reduce our consumption of the good." In period 3, seeing the proposed wage level, the firm decides between complying and raising the wages, ignoring and retaining the wages, or exiting to a different region where the minimum wage level does not have a bite. In this work, I rule out the possibility of the firm opting out of the region to a lower wage - lower productivity region than the current one: this is to make it consistent with the firm's decision in period 1. The firm may choose to move to a lower

[4]In reality, firm chooses subcontracting firms, and the subcontracting firm chooses regions to produce the good. For now, let's assume that subcontracting firm is a part of the firm that makes zero profits, and the firms make the location decision.

wage - lower productivity region if it concludes that if it were going to ignore the boycotts it may as well go to the cheapest region to minimize the losses from the boycott demand shock.

The rest of the paper is laid out as follows. After presenting the model in section 1.2, I analyze the equilibrium outcomes and discuss welfare implications in section 1.3. Section 1.4 continues the discussion and use the implications of the model in thinking about transnational activism. Section 1.5 concludes.

1.2 The Model

This section describes the basic structure of the model. Subsection 1.2.1 shows the assumptions and structure behind the demand behavior and subsection 1.2.2, behind the supply behavior.

1.2.1 Demand

There are two types of consumers - Caring (C) and Neutral (N). The C types are activists who care about the wage level of the workers that produce the goods they consume. The N types, on the other hand, are neutral and do not care about the wage level. Let us normalize the consumer population to 1 and suppose that there are $\delta \in [0, 1]$ number of C type consumers and $1 - \delta$ of N type ones.

Both types of individuals have I of wealth and choose between a numeraire good x and a consumption good q. The price of a unit of the consumption good is p. The C type gets satisfaction from consuming x, q, and from the fact that the

firm is treating its workers (who produce the good q that they consume) well. The N type gets satisfaction only from consuming x and q.

The C type or the activists chooses q to maximize

$$\max_{q_c} U_c(q_c) = x_c + f(q_c) + \alpha v(w; \hat{w})(q_c + 1) \tag{1.1}$$

such that $x_c + pq_c \leq I$. α is a constant that captures the extent to which the C type cares for the welfare of the workers. For a greater α she cares more. Activist has a reservation value - a minimum wage $\hat{w}$ that she would like the workers to earn working for the firm. This is the wage that she will demand of the firm in the boycott campaign. The function $v(w; \hat{w})$ is an indicator function that takes the value 0 or -1 depending on the relative size of w with respect to $\hat{w}$. That is,

$$v(w; \hat{w}) = \begin{cases} 0, & \text{if } w \geq \hat{w}\ ; \\ -1, & \text{if } w < \hat{w}. \end{cases}$$

Having quasi-linear preferences, the optimal consumption level of q is not affected by the income level. This is to solely focus on the effects of the different degrees of caring-ness of consumers rather than individual income differences in comparing consumption schedules. Rewriting (1.1), activist's maximization problem becomes

$$\max_{q_c} U_c(q_c) = I - pq_c + f(q_c) + \alpha v(w; \hat{w})(q_c + 1). \tag{1.2}$$

To make the model more tractable so that we can derive a closed-form solution, let's assume $f(q_c) = Aq_c - 1/2q_c^2$. (I assume that $A \geq q_c^*$ in all cases so that the level of optimal consumption will occur on the increasing part of the curve.) Having specific functional forms enables us to conduct the welfare analysis in the upcoming sections relatively easily. Maximization problem (1.2) now becomes

$$\max_{q_c} U_c(q_c) = I - pq_c + Aq_c - 1/2q_c^2 + \alpha v(w; \hat{w})(q_c + 1). \tag{1.3}$$

When we solve for the above, activist's optimal consumption of the good q_c is $q_c = A - p + \alpha v(w)$, which can be thought of as the demand function of good q for the C types. We focus only on the interior solutions. Note here that depending on $v(w; \hat{w})$ we get a shift in the demand. Suppose the current wage rate w is such that $w < \hat{w}$. Then the individual will be experiencing $-\alpha(q + 1)$ units of disutility when it consumes q units of the good. Note that even when she does not consume any of good q, the information that the workers are not paid well enough - $\hat{w}$ - causes her disutility of α.

The N type individual chooses q_n to maximize

$$\max_{q_n} U_n(q_n) = x_n + f(q_n) \tag{1.4}$$

such that $x_n + pq_n \leq I$. Note here that the utility of the neutral type is not affected by the wages of the workers that produce the good q.

Rewriting (1.4), N type's maximization problem becomes

$$\max_{q_n} U_n(q_n) = I - pq_n + f(q_n). \tag{1.5}$$

Let's assume that the N type gets the same satisfaction from q as the C types: $f(q_n) = Aq_n - 1/2q_n^2$. Maximization problem (1.5) now becomes:

$$\max_{q_n} U_n(q_n) = I - pq_n + Aq_n - 1/2q_n^2. \tag{1.6}$$

When we solve for the above maximization problem, the N type's optimal consumption schedule of the good q_n is $q_n = A - p$, which is the demand function of the good q for them. Note here that the demand only depends on the price of the good p.

Since the indirect utility functions of both types follow the Gorman form, we can sum the demands of all consumers to create an aggregate demand. Re-

call that there are δ number of type C consumers and $1-\delta$ number of type N consumers. The social aggregate demand for the good q then is $q = q_c + q_n = \delta(A - p + \alpha v(w)) + (1-\delta)(A-p) = A - p + \alpha\delta v(w)$. Note here that the aggregate demand function is $q = A - p$ if all consumers are of the N type that does not care about the wage level at the production site. When all consumers are of the C type, the aggregate demand is $q = A - p + \alpha v(w)$.

In a scenario with one representative consumer, δ can be interpreted as a parameter that measures the extent to which the consumer is concerned with the welfare of the workers. The amount of loss in utility, $\alpha\delta v(w)(q+1)$, will take the value 0 when the representative consumer is not concerned ($\delta = 0$). As δ increases, she will be negatively affected by the welfare of the workers more.

1.2.2 Supply

The firm is a monopolist, a single producer of the good. This is not an unrealistic assumption since as BdD (2005, p. 5) and others have noted, most of the firms targeted by activists are big brand name retailers that are monopolists in a sense.[5] The firm is also a monopsonist in the labor market paying a higher wage than the average local wage. Again, this assumption is justified by the empirical evidence[6] that multinational firms pay higher wages than the local firms.[7]

Figure 1.1 shows the labor supply function, marginal cost of labor, and

[5]Even when there are multiple producers of the good, as long as we assume Cournot oligopolistic competition, the basic message still holds true.

[6]for a review, refer to Brown et al. (2002).

[7]In reality, it is not the Firm (or Nike) that decides on the wage level of the workers in the production site but their respective subcontracting firms. And it is the subcontracting firms that decide where to produce. If we assume that the subcontracting firm is making zero profits because of the competition amongst them, it will be as if the firm owns the subcontracting firm.

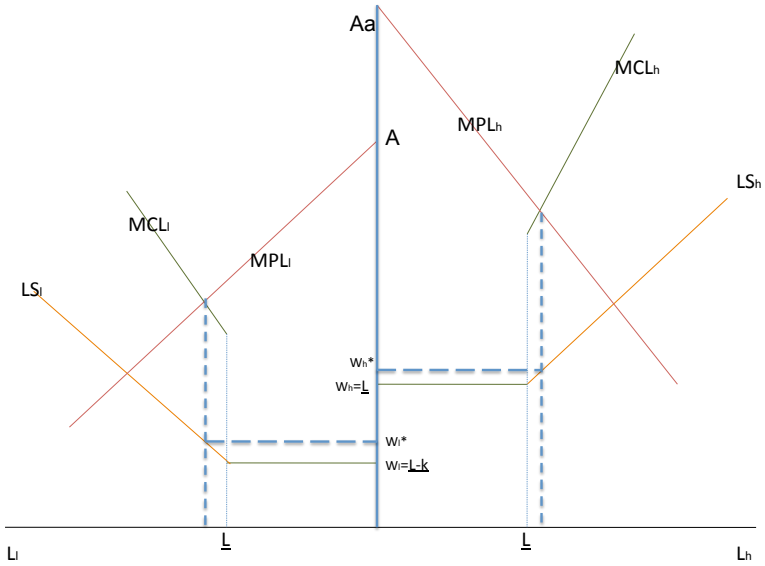

Figure 1.1: Labor Supply, Marginal Cost of Labor and Marginal Product of Labor.

marginal product of labor for two regions of production denoted by h and l. The h region has higher productivity and a corresponding high average local wage w_h when the l region has lower productivity with a corresponding low average local wage w_l.[8] For the h region, the inverse labor supply function is

$$W_h(L) = \begin{cases} w_h & \text{if } L < \underline{L}\,; \\ L, & \text{if } L \geq \underline{L}. \end{cases}$$

When the firm offers a wage less than the local average wage w_h, no one is willing to work for the firm. At the average local wage level w_h, some fraction of the population $\underline{L}$ will come to work. As the firm increases the wage beyond w_h, more people will want to work at the firm. For the l region, the inverse labor

[8]Basically I aggregate and represent the whole range of wages of the region into a single value.

supply function is characterized as

$$W_l(L) = \begin{cases} w_l & \text{if } L < \underline{L}\,; \\ L - k, & \text{if } L \geq \underline{L}. \end{cases}$$

The shape of the supply curve has a similar story as that of the high wage region. At the average local wage level w_l, some fraction of the population $\underline{L}$ will come to work. As the firm increases the wage beyond w_l, more people will want to work at the firm. Note here that k basically measures the difference between the average local wages of the high region h and the low region l. Here I have set the fraction of number of workers that will come to work at local average wages as $\underline{L}$ for both regions. The analysis continues to hold for different values of $\underline{L}$.

The production function of the h region is

$$g_h(L) = aL,$$

a linear technology where $a \geq 1$. For the l region,

$$g_l(L) = L.$$

The region h has higher productivity than region l and a captures the relative productivity difference.

In period 1 there is no information about the wages at production sites and therefore all individuals are essentially neutral: $\delta = 0$. Firm decides between two possible regions of production: a low productivity - low wage region, or a high productivity - high wage region taking into account the demand $q = A - p$ schedule. When the firm produces in h, its maximization problem will be

$$\begin{aligned} \max_L \pi_h(L) &= p(g_h(L))g_h(L) - w_h(L)L \\ &= (A - aL)(aL) - L^2. \end{aligned} \tag{1.7}$$

When the firm produces in l, the maximization problem will be

$$\begin{aligned}\max_L \pi_l(L) =& p(g_l(L))g_l(L) - w_l(L)L \\ =& (A - L)(L) - (L - k)L. \end{aligned} \tag{1.8}$$

Here, we ignore the range of L where $L < \underline{L}$ for both regions because multinational firms do pay higher wages than the local firms (Brown et al., 2002, p. 13). Solving for equations (1.7) and (1.8) and maximizing profits, the optimal amounts of employment can be calculated: $L_h^* = \dfrac{Aa}{2a^2 + 2}$ for h and $L_l^* = \dfrac{A + k}{4}$ for l.

Proposition 1.1 *Greater employment is generated if the firm operates in the low productivity region.*

Proof is in the appendix. The aggregate demand schedule $q = A - p$ is the same regardless of the production region during this stage. For the same amount of production and sales, the firm will have to hire more people in region l than h because workers in h has better skills or better infrastructure. Cheaper labor costs also induces the firm to hire more workers in l.

The firm's respective profits for producing in h and l are $\pi_h(L_h^*) = \dfrac{A^2a^2}{4a^2 + 4}$ and $\pi_l(L_l^*) = \dfrac{(A + k)^2}{8}$, which are depicted as the shaded areas in Figure 1.2. The corresponding equilibrium wage levels at each region are $w_h^* = \dfrac{Aa}{2a^2 + 2}$ and $w_l^* = \dfrac{A - 3k}{4}$. (We assume $A/3 \geq k$ to focus on interior solutions.) The prices charged to the consumer are $p_h = \dfrac{A(a^2 + 2)}{2a^2 + 2}$ and $p_l = \dfrac{3A - k}{4}$ if the good is produced in h or l, respectively. Note here that LD_l and LD_h are derived demand functions of labor when p_l and p_h are corresponding equilibrium prices of the goods.

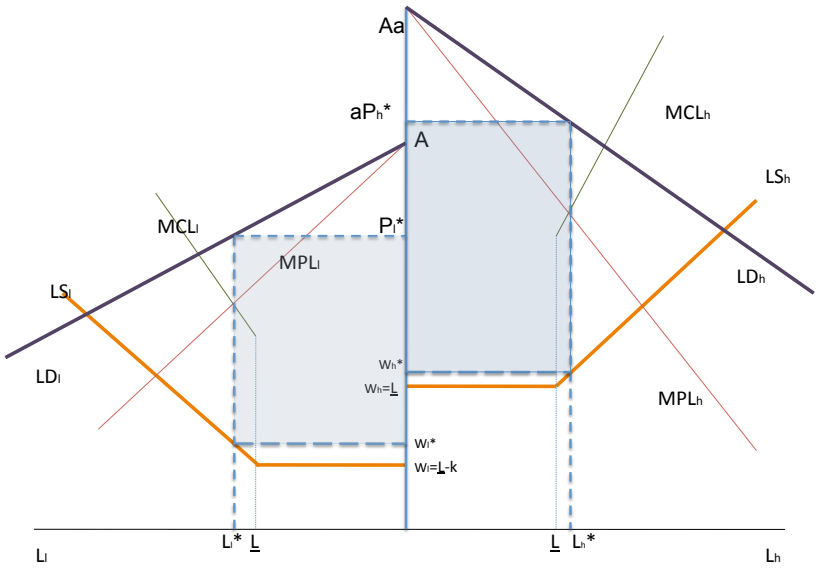

Figure 1.2: Profits for regions l and h.

Proposition 1.2 *There exists a cut-off for the wage difference* $\bar{k}(a) = A(\sqrt{\frac{2a^2}{a^2+1}} - 1)$ *such that for* $k \leq \bar{k}(a)$*, the firm yields greater profits when it operates in region h than in region l. The cut-off* $\bar{k}(a)$ *increases as the relative productivity a of region h increases.*

Proof is in the appendix. If the local average wage difference between the two region is small enough, there is not much benefit in producing in l compared to h. As the relative productivity of region h increases, however, even if the local average wage in region l is lower by k, it will be profitable for the firm to produce in h.

Let's suppose $\bar{k}(a) < k$: the l region has a local average wage low enough that the expected profit of producing there is greater than the expected profit of producing in region h. Then the firm will choose l over h for the initial production.

It will employ $L_l^* = \frac{A+k}{4}$ workers and pay them the wage of $w_l^* = \frac{A-3k}{4}$, charge the unit price $p_l = \frac{3A-k}{4}$ to the consumers and yield a profit of $\pi_l(L_l^*) = \frac{(A+k)^2}{8}$. Let's assume here that the reservation wage that the Caring type has or will be demanding of is greater than or equal to the equilibrium wage in l and less than or equal to the equilibrium wage in h: $w_l^* \leq \hat{w} \leq w_h^*$. For these inequalities to be true, a and k have to satisfy $\frac{A(a-1)^2}{3(a^2+1)} \leq k$, or $\frac{A(a-1)^2}{3(a^2+1)} \leq k \leq \frac{A}{3}$ combining with the assumption for k we have applied before.

Consumers obtain information about the welfare of the workers that produce the goods they consume. When the C type consumers learn about the wage level w_l^* paid by the firm in region l, they experience disutility. When the N type consumers learn about the wage level w_l^* in region l, they are neutral and the information does not affect them. Therefore only the C type will become activists and will threaten the firm with a reservation wage level $\hat{w}$: "if you, the firm, do not raise the wages to $\hat{w}$ each of us will reduce consumption of the good by α, which will arise to a $\alpha\delta$ decrease of the overall social demand of the good." For the rest of the analysis, let's set $\alpha = 1$ for simplification. Then we are assuming that with δ caring individuals faced with the wage level w_l^*, there will be a δ reduction in demand in the case of a boycott. Now the firm has three options. It can either 1) *Comply* and raise the wage to $\hat{w}$ and continue producing in l, 2) *Ignore* and continue producing in l, or 3) shut down the factories in l and *Move* to the h region where the announced minimum wage level does not have a bite. We calculate the respective payoffs for each scenario.

1) *Comply*

Suppose the firm Complies. It increases the wages and continues producing in l. Then the demand it will face will be $q = A - p$. There are two different

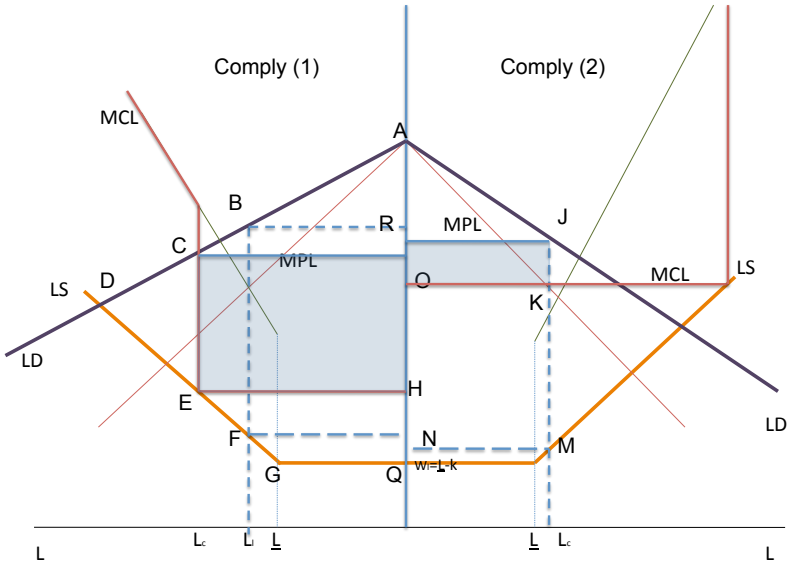

Figure 1.3: Two Cases of Comply.

profit maximizations possible depending on the size of $\hat{w}$. This is drawn in Figure 1.3. The left hand side case (Comply (1)) is where the demanded wage $\hat{w}$ is low enough so that all individuals who are willing to work at that wage are employed. The right hand side case (Comply (2)) is when $\hat{w}$ is too high for the firm to employ all the individuals who are willing to work at that wage level. The cutoff value of w that divides the two cases is the intersection of the labor supply function and the marginal product of labor[9]: $\underline{w} = \frac{A-2k}{3}$. That is, if $\hat{w} \leq \underline{w}$, then we are in Comply (1). On the other hand, if $\hat{w} \geq \underline{w}$, then we are in Comply (2). We also impose a condition for k and a: $\frac{A}{2} - \frac{3Aa}{4(a^2+1)} \leq k$ so that $\underline{w} \leq w_h^*$.

[9] $MPL = A - 2L$ and the labor supply function is $w = L - k$. Equating w and MPL, we get $\underline{w} = \frac{A-2k}{3}$.

For Comply (1), the optimal labor L_{c1} and thus the profit π_{c1} are determined as soon as $\hat{w}$ is set. From the labor supply function $w = L - k$, we get $L_{c1} = \hat{w} + k$. The profit is

$$\begin{aligned}\pi_{c1}(L_{c1}) &= p(g_l(L_{c1}))g_l(L_{c1}) - \hat{w}L_{c1} \\ &= (A - (\hat{w} + k))(\hat{w} + k) - (\hat{w} + k)\hat{w} \\ &= (A - 2\hat{w} - k))(\hat{w} + k). \end{aligned} \tag{1.9}$$

The price of the good is $p_{c1} = A - L_{c1} = A - \hat{w} - k$. Again, this is for $\hat{w} \leq \underline{w}$ only. For Comply (2), The profit maximization problem the firm faces in region l paying $\hat{w}$ is

$$\begin{aligned}\max_L \pi_{c2}(L_{c2}) &= p(g_l(L_{c2}))g_l(L_{c2}) - \hat{w}L_{c2} \\ &= (A - L_{c2})(L_{c2}) - L_{c2}\hat{w}. \end{aligned} \tag{1.10}$$

When $\hat{w} \geq \underline{w}$, the employment that maximizes the profit is $L_{c2} = \dfrac{A - \hat{w}}{2}$. The respective profit is $\pi_{c2} = \dfrac{(A - \hat{w})^2}{4}$ and the price charged to the consumers is $p_c = \dfrac{A + \hat{w}}{2}$.

The shaded areas in Figure 1.3 are the respective profits. Note here that for all $L_{c1} = L_{c2}$, $\pi_{c1} > \pi_{c2}$. Let's suppose for wage demands $\hat{w}$ and $\hat{w}'$, $\hat{w} \leq \underline{w} \leq \hat{w}'$. The firm's profit maximizing employments are the same for both cases as L. The firm will be making less profits when it is forced to pay $\hat{w}'$ rather than $\hat{w}$. This seemingly obvious observation will be useful when we analyze the behavior of the firm later on. We can write the profits of the two comply functions into one:

$$\pi_c(\hat{w}) = \begin{cases} (A - 2\hat{w} - k))(\hat{w} + k), & \text{if } \hat{w} \leq \underline{w}\ ; \\ \dfrac{(A - \hat{w})^2}{4}, & \text{if } \hat{w} \geq \underline{w}. \end{cases}$$

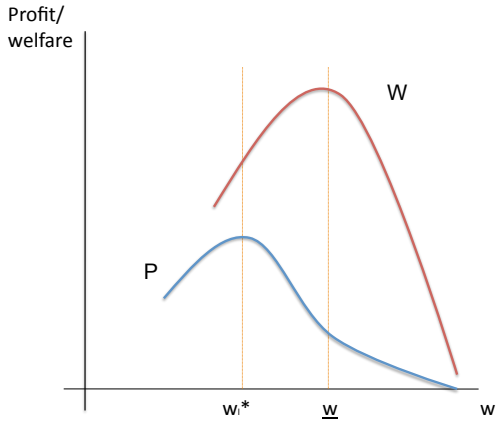

Figure 1.4: Profits and Social Welfare for a Complying Firm.

Proposition 1.3 *The profit of the firm $\pi_c(\hat{w})$ is maximized when $\hat{w} = w_l^*$. As $\hat{w}$ increases from w_l^*, the firm's profit decreases.*

Proposition 1.4 *As $\hat{w}$ increases from w_l^*, social welfare or the total surplus increases and is maximized when $\hat{w} = \underline{w}$. As $\hat{w}$ increases further, the total surplus decreases.*

Proofs are the appendix. Looking at Figure 1.3, we see that the total surplus is the area ACEGQ which will be maximized at $\hat{w} = \underline{w}$. In Figure 1.4, we can depict the profits and social welfare for the Comply case with increasing $\hat{w}$.

2) *Ignore*

Suppose the firm Ignores the boycott threat, refuses to increase the wages and continues producing in l. Then the demand it faces is $q = A - p - \delta$ because

the C type consumers would have boycotted. The profit maximization problem of the firm producing in l now becomes:

$$\begin{aligned}\max_L \pi_l(L) =& p(g_l(L))g_l(L) - w(L)L \\ =& (A - \delta - L)(L) - L(L - k). \end{aligned} \tag{1.11}$$

The employment that maximizes the profit is $L_i = \dfrac{A - \delta + k}{4}$ which is lower than the employment rate before the threat $L_l^* = \dfrac{A + k}{4}$. The respective profit now becomes $\pi_i = \dfrac{(A - \delta + k)^2}{8}$. Note here that the equilibrium wage is $w_i(L_i) = \dfrac{A - \delta - 3k}{4}$, which is even lower than the wage level before the boycott threat $w_l^* = \dfrac{A - 3k}{4}$. This is the boycott backlash where because of activism, less workers are employed at a lower wage rate. Price charged to the consumers now becomes $p_i = \dfrac{3(A - \delta) - k}{4}$.

3) *Move*

Suppose the firm exits from the l region and Move to h. Then the demand function the firm will face will be $q = A - p$ since the activist's reservation wage $\hat{w}$ would be lower than the equilibrium wage w_h^*.[10] The profit maximization problem (1.7) solved previously applies here. The optimal employment for the high region is $L_h^* = \dfrac{Aa}{2a^2 + 2}$ and the firm's profits then becomes $\pi_h^*(L_h^*) = \dfrac{A^2a^2}{4a^2 + 4}$. The corresponding wage level is $w_h^* = \dfrac{Aa}{2a^2 + 2}$ and the price charged to the consumers is $p_h^* = \dfrac{A(a^2 + 2)}{2a^2 + 2}$. Note here that the workers in the l region is back to receiving the average local wage of w_l. They have become worse off because of the boycott campaign.

[10]How realistic is it to assume that the activists only care for wages that the producers pay, and not the overall well-being of the workers in the low wage region? This assumption is not too far-fetched since consumers do not care about the working environments of any poor country. They are bothered by the fact that a multinational firm "exploits" cheap labor and they end up consuming such blood-tainted products.

1.3 Analysis

This section combines and analyzes the results presented in the previous section. Subsection 1.3.1 discusses the decisions of the firm depending on different parameter values. Subsection 1.3.2 analyzes the welfare consequences of each decision, and subsection 1.3.3 demonstrates it with a specific example. Subsection 1.3.4 gives a simplified model for a situation when there is no technological difference across regions and subsection 1.3.5 demonstrates it with an example.

1.3.1 Decision Making

Let us analyze the three possible outcomes. By assumption, the firm chooses region l over h for initial production ($\pi_l^* > \pi_h^*$) which leads us to a condition for k and a: $k \geq A(\frac{\sqrt{2}a}{\sqrt{a^2+1}} - 1)$. We have also assumed that $\underline{w} \leq w_h^*$, which gives us $\frac{(A-2k)}{3} \leq \frac{A}{4}$, or $A \leq 8k$. Now, w_l^* is known and the C type consumers demand a minimum wage of $\hat{w}$ for the workers. What will be the firm's response?

Let's divide the cases into two: $\pi_h \leq \pi_i$ and $\pi_i \leq \pi_h$. When $\pi_h \leq \pi_i$, it is more profitable for the firm to Ignore than to Move, and when $\pi_i \leq \pi_h$, it is more profitable for the firm to Move than to Ignore.

Proposition 1.5 *If $\delta \leq \tilde{\delta}$, where $\tilde{\delta} = k - \bar{k}(a) = k - A(\sqrt{\frac{2a^2}{a^2+1}} - 1)$, it is more profitable for the firm to Ignore than to Move. If $\delta \geq \tilde{\delta}$, it is more profitable for the firm to Move than to Ignore. $\tilde{\delta}$ increases as k increases and a decreases .*

The proof is in the appendix. The proposition states that when the number of Caring individuals becomes too large, the size of the demand cut is too big for

the firm to bear and the firm will choose to relocate to h. As $a > 1$ increases, the maximum number of caring people whose demand the firm chooses to ignore, $\tilde{\delta}$, will go down. In other words, the firm will move to h if the productivity of the h region goes up, all other things equal, when there is a protest. Similarly, if wage difference between the two regions increases, the firm is more likely to stay and ignore in region l because of the cheaper wage. Another thing to note here is that $\tilde{\delta}$ may be positive or negative depending on the relative sizes of a and k. What happens when $\tilde{\delta} < 0$? Since by assumption $\delta \in [0, 1]$, we have $\delta \geq \tilde{\delta}$ and the firm will always Move.

Suppose $\delta \leq \tilde{\delta}$. If given a choice between Ignore and Move, the firm will Ignore ($\pi_h \leq \pi_i$). We can now focus on the decision between Comply and Move.

Proposition 1.6 *When $\delta \leq min[\bar{\delta}, \tilde{\delta}]$, there exists a unique cut-off $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$ the firm Ignores.*

Here, $\bar{\delta} = (1 - \sqrt{2}(1 - \frac{a}{2(a^2+1)}))A + k$. The proof using the Intermediate Value Theorem is in the appendix. Suppose $\delta \leq min[\bar{\delta}, \tilde{\delta}]$ and there exists a unique cut-off $\hat{w}$ that divides the firm's action between Comply and Ignore. One can solve for $\hat{w}$ for two scenarios: the first scenario is when the profit for Ignore satisfies the inequality $\pi_i \geq \pi_c(\underline{w})$ and $w^* \leq \underline{w}$. The second scenario is when the profit of Ignore satisfies the inequality $\pi_i \geq \pi_c(\underline{w})$ and $w^* \geq \underline{w}$. For each scenario, there exists a cut-off $\hat{w}$ beyond which the firm ignores and takes the demand hit rather than complies.

Scenario 1. ($\pi_h \leq \pi_i$, $\pi_c(\underline{w}) \leq \pi_i$

Proposition 1.7 *When δ satisfies $\delta \leq min[\tilde{\delta}, (1 - \frac{2\sqrt{2}}{3})(A+k)]$, there will exist a unique*

$\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore.

Here, if we write out $\bar{w}$, it is $\bar{w} = \frac{A-3k}{4} + \frac{\sqrt{\delta(2A+2k-\delta)}}{4}$. Note here that the condition $\delta \leq \bar{\delta}$ that guarantees the existence of a cut-off is dropped. This is because $(1 - \frac{2\sqrt{2}}{3})(A+k) \leq \bar{\delta}$.[11] Proof for the proposition is in the appendix. This result is intuitive: for lower $\hat{w}$, firm will comply. For higher $\hat{w}$, since the firm will be suffering too much loss if it complies, it will ignore the demand.

Proposition 1.8 *$\bar{w}$ decreases with increasing k and decreasing δ.*

Proof is in the appendix. Lowering of the the average local wage for l (i.e., increasing k) has the same effect as a higher wage demand $\hat{w}$: firms are more likely to ignore so $\bar{w}$ decreases. Increasing number of caring individuals mean that if you ignore, you will be suffering more losses. So one is more likely to comply and therefore $\bar{w}$ increases. Figure 1.5 depicts this.

Scenario 2. $\pi_h \leq \pi_i \leq \pi_c(\underline{w})$

Proposition 1.9 *When δ satisfies $\delta \leq min[\bar{\delta}, \tilde{\delta}]$ and $\delta \geq (1 - \frac{2\sqrt{2}}{3})(A+k)$, there will exist a unique $\tilde{w} \geq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \geq \tilde{w}$ the firm will comply. For $\hat{w} \leq \tilde{w}$ the firm will Ignore.*

Note here that $\tilde{w} = \frac{(\sqrt{2}-1)A + \delta - k}{\sqrt{2}}$ and is greater than $\underline{w}$. Proof of this proposition is in the appendix. Intuitively, for a lower $\hat{w}$ the firm will comply. For a higher $\hat{w}$ the firm will ignore. One thing to note here is that depending on the

[11] For δ that satisfies $\delta \leq (1 - \frac{2\sqrt{2}}{3})(A+k)$ (which corresponds to $\pi_i \geq \pi_c(\underline{w})$) with A, k, and a that satisfy $\frac{(A-2k)}{3} \geq \frac{Aa}{2(a^2+1)}$ (which corresponds to $\underline{w} \geq w_h^*$), we have $\delta \leq \bar{\delta}$.

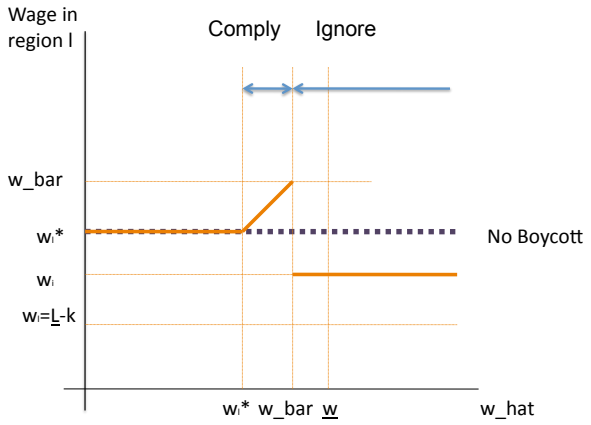

Figure 1.5: Changes in Wages in l in Scenario 1.

values of k, A, and a there may be no δ that can satisfy both $\delta \leq min[\bar{\delta}, \tilde{\delta}]$ and $\delta \geq (1 - \frac{2\sqrt{2}}{3})(A + k)$ and gives us $\pi_h \leq \pi_i \leq \pi_c(\underline{w})$.

Proposition 1.10 *$\tilde{w}$ decreases as k increases and δ decreases.*

Proof is in the appendix. Lowering of the the average local wage for l (i.e., increasing k) firms are more likely to ignore because the lower wage becomes an incentive: the cut-off $\tilde{w}$ decreases. When there are many caring individuals, the firm is more likely to Comply for higher $\hat{w}$ because the negative demand shock of the boycott campaign is expected to be great. We can draw the actual wage of region l with respect to $\hat{w}$ in Figure 1.6. If $\bar{\delta} \leq \delta \leq \tilde{\delta}$, then the firm will Comply for all $\hat{w} \in [w_l^*, w_h^*]$. If $\tilde{\delta} \leq \bar{\delta}$ and $\tilde{\delta} \leq \delta \leq \bar{\delta}$, then the firm will either comply or move for all $\hat{w} \in [w_l^*, w_h^*]$.

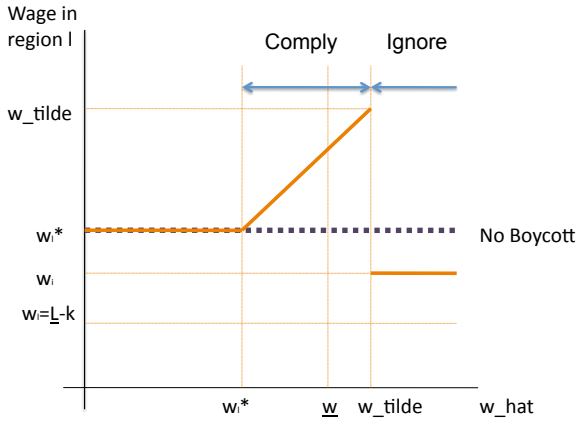

Figure 1.6: Changes in Wages in l in Scenario 2.

That is, suppose $\delta \geq \tilde{\delta}$. If given a choice between Ignore and Move, the firm will Move ($\pi_i \leq \pi_h$). Under this assumption, we can focus on the decision between Comply and Move.

Proposition 1.11 *When δ satisfies $\delta \geq \tilde{\delta}$ and $-4a^3 + 5a^2 - 4a + 4 \leq 0$, there exists a unique cutoff $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$, the firm Moves.*

Suppose $\delta \geq \tilde{\delta}$ and $-4a^3 + 5a^2 - 4a + 4 \leq 0$, and we know there exists a unique cut-off $\hat{w}$ that divides the firm's action between Comply and Move. One can solve for the cut-off $\hat{w}$ for two scenarios: scenario 3 is when the profit for Move satisfies the inequality $\pi_h \geq \pi_c(\underline{w})$ and w^* thus satisfies $w^* \leq \underline{w}$. Scenario 4 is when the profit of Move satisfies the inequality $\pi_h \leq \pi_c(\underline{w})$ and thus $w^* \geq \underline{w}$. For

each scenario, there exists a cut-off $\hat{w}$ beyond which the firm will Move rather than Comply.

Scenario 3. $\pi_i \leq \pi_h$, $\pi_h \geq \pi_c(\underline{w})$

Proposition 1.12 *When δ satisfies $\delta \geq \tilde{\delta}$ and k satisfies $k \leq A(\frac{3a}{2\sqrt{a^2+1}} - 1)$, there will exist a $\check{w} < \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \check{w}$ the firm will Comply. For $\hat{w} \geq \check{w}$ the firm will Move.*

Proof is in the appendix. Here $\check{w} = \frac{A-3k}{4} + \sqrt{\frac{(A+k)^2}{16} - \frac{a^2A^2}{8(a^2+1)}}$. The condition for k corresponds to the restriction that $\pi_h \geq \pi_c(\underline{w})$.[12] For lower $\hat{w}$ the firm will comply. For higher $\hat{w}$, the firm will move.

Proposition 1.13 *$\check{w}$ increases with k increasing and a decreasing.*

Proof is in the appendix. As productivity of h region a decreases, firm is less likely to move out from l, so the cut-off $\check{w}$ increases. As the wage gap k increases, it is more profitable to stay in region l so the cut-off $\check{w}$ increases as well. Figure 1.7 depicts the change in wages in region l.

Scenario 4. $\pi_i \leq \pi_h$, $\pi_h \leq \pi_c(\underline{w})$

Proposition 1.14 *When δ satisfies $\delta \geq \tilde{\delta}$, k satisfies $k \geq A(\frac{3a}{2\sqrt{a^2+1}} - 1)$, and a satisfies $-4a^3 + 5a^2 - 4a + 4 \leq 0$, there will exist a $\dot{w} > \underline{w}$ such that for $\hat{w} \leq \dot{w}$ the firm will Comply. For $\hat{w}$ satisfying $\hat{w} \geq \dot{w}$, the firm will Move .*

[12] Again, the $-4a^3 + 5a^2 - 4a + 4 \leq 0$ condition is dropped from the proposition because it will be guaranteed when the k condition is satisfied.

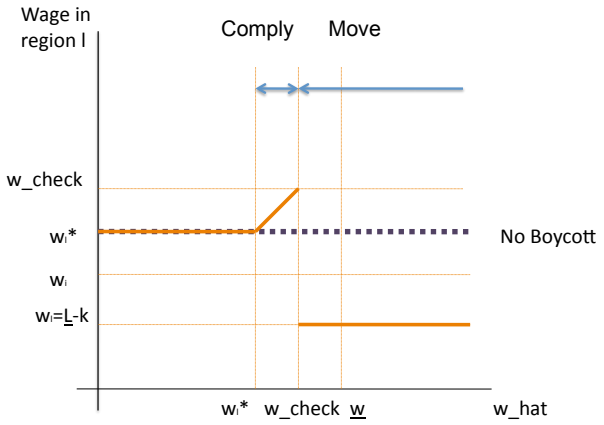

Figure 1.7: Changes in Wages in l in Scenario 3.

Note here that $\dot{w} = A(1 - \frac{a}{\sqrt{a^2+1}})$. Proof is in the appendix. If the wage demanded by the boycotters is too high, the firm could yield a higher profit moving out of region l to h rather than staying in l and complying.

Proposition 1.15 *$\dot{w}$ increases as a decreases.*

Proof is in the appendix. As the relative productivity of workers in region h compared to that in region l decreases, the minimum wage cut-off that will make the firm to relocate will go up. Suppose the productivity difference is close to zero. Then moving to the other region may not increase the firm's profit that much - so the wage increase that the firm is willing to bear instead of moving out to h will go up. We can draw the actual wage of region l with respect to $\hat{w}$ in Figure 1.8. Finally, when $\delta \geq \tilde{\delta}$ and $-4a^3 + 5a^2 - 4a + 4 \geq 0$, we have

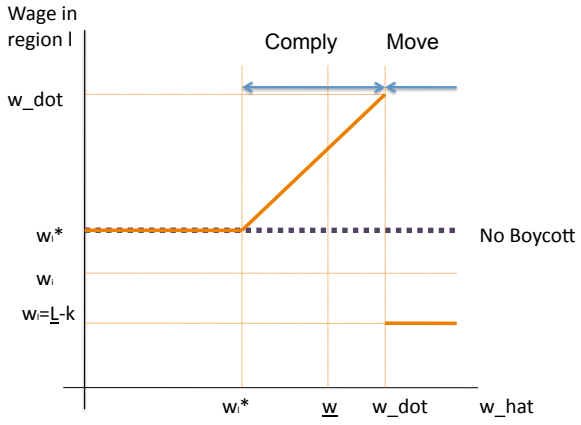

Figure 1.8: Changes in Wages in l in Scenario 4.

$\pi_c(w_h^*) \geq \pi_h(w_h^*)$. Then for all $w^* \in [w_l^*, w_h^*]$, the firm will always comply. In sum, given an announced $\hat{w}$, we can predict how firms behave looking at the parameters δ, k, and a.

1.3.2 Welfare Analysis

One can estimate the welfare effects to the consumers, workers, and the firm from the product boycott for each scenario described in the previous section. We can also look at the first best outcomes with regards to social welfare.

Scenario 1: firm Complies for a low $\hat{w} \leq \bar{w}$, Ignores for a high $\hat{w} \geq \bar{w}$ ($\tilde{\delta} \geq \delta$, $\hat{w} \leq \underline{w}$)

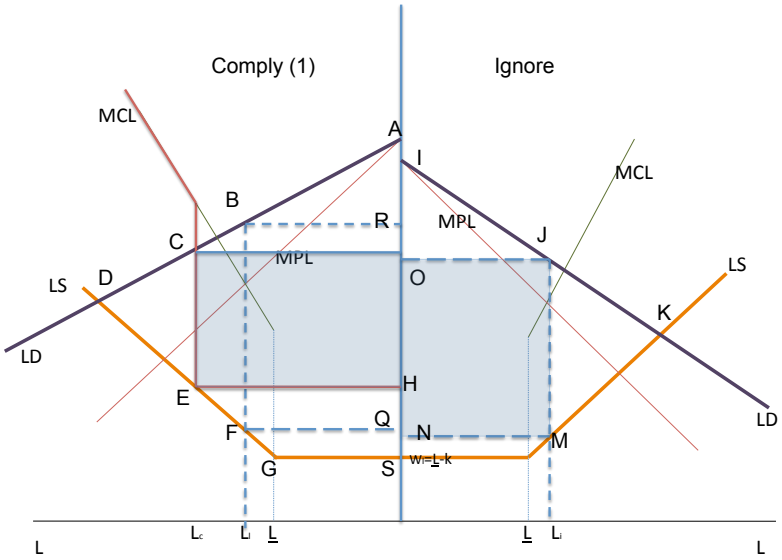

Figure 1.9: Comparison Between Comply and Ignore for Scenario 1.

Let's study the marginal cost and product of labor graph in Figure 1.9. Since the firm is a monopolist and a monopsonist, there is a social welfare loss when the firm is maximizing its profits in region *l*. The area BDF is the dead weight loss. Note here that when $\hat{w}$ has a bite and the firm complies, the deadweight loss decreases with increasing $\hat{w}$. Suppose the minimum wage is at the level EH. Then the deadweight loss becomes the area CDE, which is smaller than BDF. The consumer surplus ACO increases with increasing $\hat{w}$, and the worker's surplus EGSH increases as well.

Boycott activism can attain the maximum total surplus when $\hat{w} = \bar{w}$. This is because we know that $L_i < L_l^*$ and therefore the total surplus of the Ignore case in scenario 1, IJMTS, is less than the total surplus ABFGS when the firm is profit maximizing. We compare the workers' surplus, consumers' surplus and firm's

surplus (profit) at $\hat{w} = \bar{w}$ between Comply and Ignore. First of all, we know that the workers' surplus before the boycott threat, FQGS, is greater than the workers' surplus when the firm ignores, NSTM. The two trapezoids FQGS and NSTM are similar, and with the distance FQ (L_l^*) longer than the distance NM (L_i), we know that $FQGS(w_l^*) > NSTM(w_i)$. We also know that $FQGS(\hat{w} = \bar{w}) > FQGS(w_l^*)$, which implies $FQGS(\hat{w} = \bar{w}) > NSTM(w_i)$. For the firm, the profit will be equal for Comply and Ignore at $\hat{w} = \bar{w}$. For consumer surplus, we compare the triangles ABR and IJO which are also similar. With the same logic as the workers' surplus case, we can see that $ABR(\hat{w} = \bar{w}) > ABR(w_l^*) > IJO(w_i)$. Therefore, the total surplus which is the summation of consumer surplus, producer surplus, and workers' surplus, we see that the total surplus of producing at l without the boycott threat $ABFGS(w_l^*)$ is greater than the Ignore case $ISTMJ(w_i)$ and since $ABFGS(\hat{w})$ increases as $\hat{w}$ increases, we see that the total welfare is maximized at $\hat{w} = \bar{w}$.

Scenario 2: firm complies for low $\hat{w} \leq \tilde{w}$, Ignores for high $\hat{w} \geq \tilde{w}$. ($\tilde{\delta} \geq \delta$, $\hat{w} \geq \underline{w}$)

Looking at Figure 1.10, one sees that at $\hat{w} = \underline{w}$, the firm can achieve the maximum profit by complying. This is because the area that represents the profit, BUQV, decreases as $\hat{w}$ increases from $\underline{w}$. (You can see this by looking at how the lengths BU and UQ shorten as $\hat{w}$ increases.) Suppose the minimum wage $\hat{w}$ is at the level EH and $\hat{w} \geq \underline{w}$. Then the deadweight loss becomes the area CDF, which is greater than BDU at $\hat{w} = \underline{w}$. As $\hat{w}$ increases from $\underline{w}$, consumer surplus ACR decreases. The changes in workers' surplus is ambiguous because even though the wage of the employed goes up, the overall employment goes down as $\hat{w}$ increases. If we look at the total surplus, ACFGS, with respect to changes in $\hat{w}$,

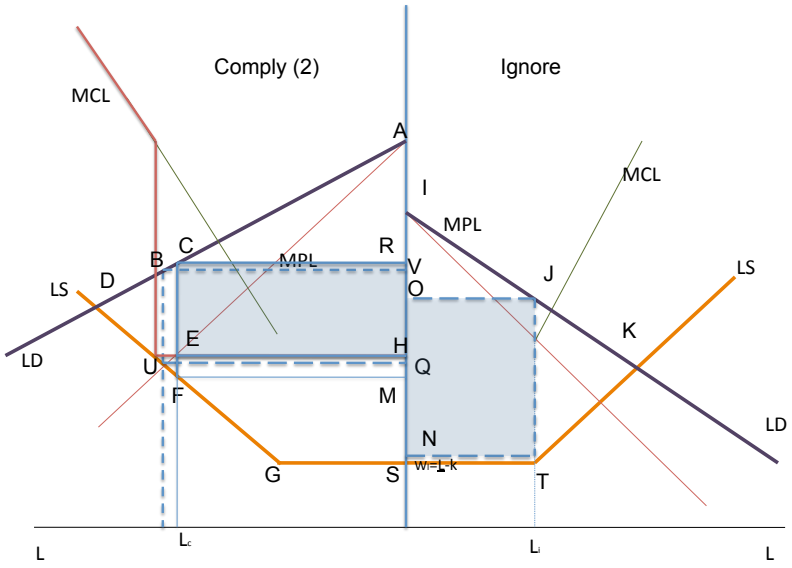

Figure 1.10: Comparison Between Comply and Ignore for Scenario 2.

we can see that it decreases as $\hat{w}$ increases. Thus the total surplus is maximized when $\hat{w} = \underline{w}$. Let's now compare this with the total surplus maximization in the Ignore case. Again, we know that $L_i < L_l^*$, and therefore the total surplus of the Ignore case, IJST, is less than the total surplus when the firm is profit maximizing (the same logic used in the analysis of scenario 1 applies here). The profit maximizing total surplus is less than the total surplus at $\hat{w} = \underline{w}$. Therefore the total surplus maximizing $\hat{w}$ is $\underline{w}$.

That is, by announcing $\underline{w}$, not only are you raising the wages of the workers and maximizing the workers' surplus, consumer surplus is maximized and firm's profit is maximized (within scenario 2). Overall, the total surplus is maximized.[13]

[13]One thing to note here is that there will not be a situation where the deadweight loss be-

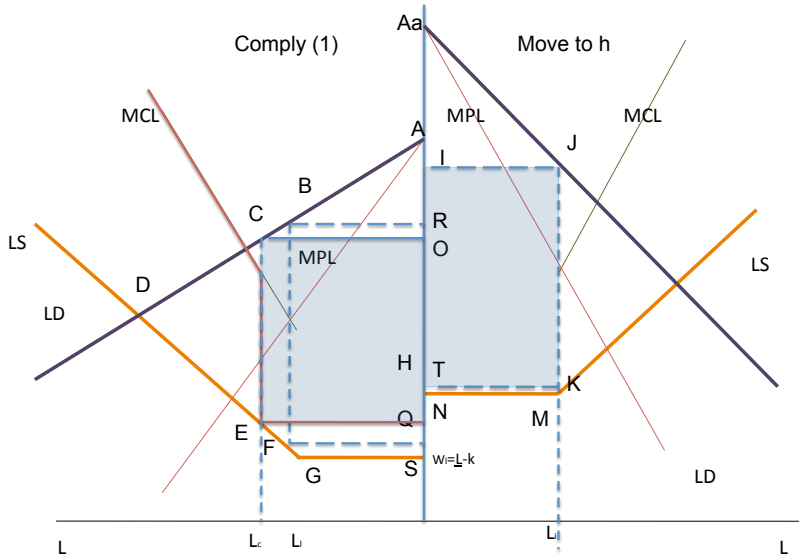

Figure 1.11: Comparison between Comply and Move for Scenario 3.

Scenario 3: firm Complies for a low $\hat{w} \leq \check{w}$, Moves for a high $\hat{w} \geq \check{w}$ ($\tilde{\delta} \leq \delta$, $\hat{w} \leq \underline{w}$)

In Figure 1.11, the area BDF is the dead weight loss. Note here that when $\hat{w}$ has a bite and the firm complies, the deadweight loss decreases. Suppose the minimum wage is at the level EH. Then the deadweight loss becomes the area CDE, which is smaller than BDF. That is, as $\hat{w}$ increases, the deadweight loss decreases and the total surplus increases. This is a combination of the consumer surplus ACO increasing, worker's surplus EGSH increasing, and profit CEOH decreasing with increasing $\hat{w}$.

comes zero. This is because even if the $\hat{w}$ is set to the point where labor supply meets labor demand, there will not be full employment but only upto the point where the marginal product of labor curve meets the $\hat{w}$.

What is the maximum total surplus the boycott activism can attain? This scenario is a bit tricky because We do not know whether the profit maximizing total surplus in h is less than the profit maximizing total surplus in l. The relative sizes will depend on a and k.

Suppose AaJKMN, the profit maximizing total surplus in region h, (denoted by TS_h) is greater than the profit maximizing total surplus of region l, $ABFGS(w_l^*)$ (denoted by TS_l). This is due to the possible surplus for consumers: even though profit maximizing profit in region l is greater than that of region h and profit maximizing workers' surplus of l is greater than that of h, if consumer surplus of producing in h is great enough to make up for the loss in firm's and worker's surplus, it will be better for the overall society to produce in h. Then as $\hat{w}$ increases, TS_l increases. When $\hat{w}$ reaches $\check{w}$, the firm will move to h but we still do not know for sure whether $TS_l(\check{w})$ is greater or less than TS_h. On the other hand, when $TS_h < TS_l(w_l^*)$, then the maximum total surplus in this scenario is reaped when the firm complies to the wage demand $\hat{w} = \check{w}$.

Scenario 4: firm Complies for low $\hat{w} \leq \dot{w}$, Moves for a high $\hat{w} \geq \dot{w}$ ($\tilde{\delta} \leq \delta$, $\hat{w} \geq \underline{w}$)

In Figure 1.12, the firm can achieve the maximum profit at $\hat{w} = \underline{w}$ in region l. Suppose the minimum wage $\hat{w}$ is at the level EH and $\hat{w} \geq \underline{w}$. Then the deadweight loss becomes the area CDF, which is greater than BDU when $\hat{w} = \underline{w}$. As $\hat{w}$ increases from $\underline{w}$, deadweight loss increases and consumer surplus ACR decreases. The changes in workers' surplus is ambiguous because even though the wage of the employed goes up, the overall employment goes down with increasing $\hat{w}$. When the firm complies, the total surplus maximization will occur at $\hat{w} = \underline{w}$, similar to scenario 2.

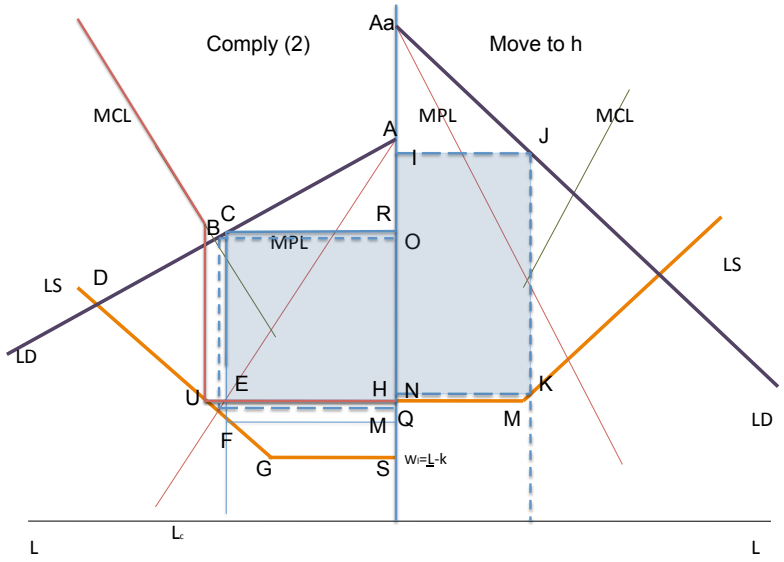

Figure 1.12: Comparison between Comply and Move for Scenario 4.

What is the maximum total surplus that the boycott activism can generate? Suppose AaJKMN, the profit maximizing total surplus of region h, TS_h, is greater than the profit maximizing total surplus of region l, TS_l. As $\hat{w}$ increases from $\underline{w}$ the total surplus decreases. At $\dot{w}$, the firm will move out to h. Here $TS_l(\dot{w})$ may or may not be greater than TS_h. This will depend on the relative sizes of a and k. On the other hand, suppose $TS_h < TS_l(w_l^*)$. Then the maximum total surplus in this scenario is generated when the firm complies to the wage demand $\hat{w} = \underline{w}$. As $\hat{w}$ increases from $\underline{w}$, total surplus goes down.

1.3.3 Analysis when $a = 1.3$, $A = 2$, $k = 1/3$

Now we go over an example when $a = 1.3$, $A = 2$, $k = 1/3$ (note here that this satisfies $\frac{(A-2k)}{3} \leq \frac{A}{4}$, or $A \leq 8k$) and predict the behavior of the firm with respect to δ. The two regions have different productivities and different local average wage levels specified as $w_h = w_l + 1/3$.

Solving the maximization problems of each region, the optimal amounts of employment are $L_h^* = \frac{Aa}{2a^2+2} = 0.483$ and $L_l^* = \frac{A+k}{4} = \frac{2+1/3}{4} = 0.583$. The firm's respective profits will be $\pi_h(L_h^*) = \frac{A^2a^2}{4a^2+4} = 0.628$ and $\pi_l(L_l^*) = \frac{(A+k)^2}{8} = 0.681$. The corresponding wage level in each region is $w_h^* = \frac{Aa}{2a^2+2} = 0.483$ and $w_l^* = \frac{A-3k}{4} = 0.25$.

The price charged to the consumer if the good is produced in h is $p_h = \frac{A(a^2+2)}{2a^2+2} = 1.372$ and if produced in l, $p_l = \frac{3A-k}{4} = 1.417$. Since the low wage region yields greater profits than the high wage region, the firm will always initially produce in l, paying wage of $w_l^* = \frac{1}{4}$ and setting the price at $p_l = 1.417$. Note here that $\underline{w} = \frac{A-2k}{3} = 0.444$.

The $w_l^* = \frac{1}{4}$ is known and the C type consumers demand $\hat{w} \in [0.25, 0.483]$ for the workers. What will be the firm's response? Let's first calculate the values $\tilde{\delta}$ and $\bar{\delta}$, plugging in $a = 1.3$, $A = 2$, $k = 1/3$: $\tilde{\delta} = k - \bar{k}(a) = 1/3 - 2(\sqrt{\frac{2(1.3)^2}{(1.3)^2+1}} - 1) = 0.091$ and $\bar{\delta} = (1 - \sqrt{2}(1 - \frac{a}{2(a^2+1)}))A + k = 0.344$. Note here that $\tilde{\delta} < \bar{\delta}$. From Proposition 1.5, if $\delta \leq 0.091$, it is more profitable for the firm to Ignore than to Move. If $\delta \geq 0.091$, it is more profitable for the firm to Move than to Ignore.

Suppose $\delta \leq 0.091$. If given a choice between Ignore and Move, the firm will Ignore. We can now focus on the decision between Comply and Move. From

Proposition 1.6, we know that when $\delta \leq 0.091$, there exists a unique cut-off $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$ the firm Ignores.

From Proposition 1.7, when δ satisfies $\delta \leq min[\tilde{\delta}, (1-\frac{2\sqrt{2}}{3})(A+k)]$, there exists a unique $\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore. Since $(1 - \frac{2\sqrt{2}}{3})(A + k) = 0.1334$, $min[\tilde{\delta}, (1 - \frac{2\sqrt{2}}{3})(A + k)] = 0.091$.

When $\delta \leq 0.091$, there will exist a unique $\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore.

When $\delta \geq 0.091$, if given a choice between Ignore and Move, the firm will Move. Under this assumption, we can focus on the decision between Comply and Move.

From Proposition 1.11, when δ satisfies $\delta \geq 0.091$ and $-4a^3 + 5a^2 - 4a + 4 \leq 0$ (which is satisfied for $a = 1.3$), there exists a unique cut-off $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$, the firm Moves.

From Proposition 1.12, when δ satisfies $\delta \geq 0.091$ there will exist a $\check{w} < \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \check{w}$ the firm will Comply. For $\hat{w} \geq \check{w}$ the firm will Move. This is because for the values $a = 1.3$, $A = 2$, and $k = 1/3$, k satisfies $k \leq A(\frac{3a}{2\sqrt{a^2+1}} - 1)$.)

To sum up the above results: for $\delta \leq 0.091$, there exists a unique $\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore. (This corresponds to scenario 1.) Total welfare is maximized at $\hat{w} = \bar{w}$.

For δ satisfying $0.091 \leq \delta$, there exists a $\check{w} < \underline{w}$ such that for $\hat{w}$ satisfying

$\hat{w} \leq \check{w}$ the firm will Comply. For $\hat{w} \geq \check{w}$ the firm will Move. (This corresponds to scenario 3.) Total welfare is maximized at $\hat{w} = \check{w}$. (The total surplus when producing in l is greater than the total surplus producing in h at the initial decision making stage.)

1.3.4 Analysis when $a = 1$

For expositional purposes, we do two exercises: the current subsection will solve for the case when $a = 1$. The next subsection will solve for a more specific case where $a = 1, A = 2, k = 1/3$.

When we set $a = 1$, it means that there are two regions of production denoted by h and l with the same productivity but different local average wage levels, where $w_h = w_l + k$. Where will the firm initially produce before boycotts? The optimal amounts of employment are: for the high region, $L_h^* = \frac{A}{4}$, and for the low region, $L_l^* = \frac{A+k}{4}$. If the firm operates at the low wage region it will be generating more employment than when it operates in the high wage region.

The firm's respective profits become $\pi_h(L_h^*) = \frac{A^2}{8}$ and $\pi_l(L_l^*) = \frac{(A+k)^2}{8}$, depicted by the shaded areas in Figure 1.13. The corresponding wage level at each region will be $w_h^* = \frac{A}{4}$, and $w_l^* = \frac{A-3k}{4}$. The price charged to the consumer if firm produces in h is $p_h = \frac{A(3)}{4}$ and in l, $p_l = \frac{3A-k}{4}$. The low wage region yields greater profits than the high wage region for all $k \geq 0$. The firm will always initially produce at l, paying the wage $w_l^* = \frac{A-3k}{4}$ and setting price at $p_l = \frac{3A-k}{4}$. Moreover, for all $0 \leq k \leq \frac{A}{3}$, we are guaranteed $w_l^* \leq w_h^*$.[14]

[14]This comes from plugging in $a = 1$ to $\frac{A(a-1)^2}{3(a^2+1)} \leq k$, a condition for k which guarantees

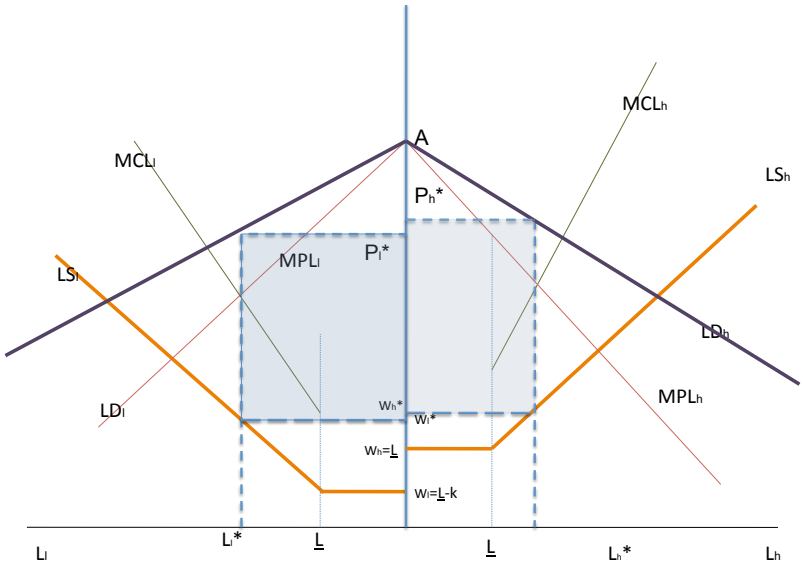

Figure 1.13: Two Regions with the Same Productivity.

Faced with a product boycott, the firm has three options. 1) *Comply* and raise the wage to $\hat{w}$ and continue producing in l, 2) *Ignore* and continue producing in l, or 3) *Move* the production to the h region where the announced minimum wage level does not have a bite. We calculate the respective payoffs for the three cases.

Let us analyze the three possible outcomes. The firm chose region l over h for initial production for all wage level difference k. The w_l^* is known and the C type consumers demand $\hat{w}$ for the workers. What will be the firm's response?

Applying $a = 1$ to Proposition 1.5 so that we can get the conditions of which the firm prefers Ignore to Move, we get $\tilde{\delta} = k$. That is, when there is no productivity difference between the two regions h and l, if δ satisfies $\delta \leq k$, it is more

$w_l^* \leq w_h^*$. We also assumed that $\underline{w} \leq w_h^*$, which gives us $\frac{(A-2k)}{3} \leq \frac{A}{4}$ or $A \leq 8k$.

profitable for the firm to Ignore than to Move. In other words, if the number of Caring individuals becomes greater than k, the size of the demand cut is too large for the firm to bear and it will choose to relocate to h rather than to ignore.

Suppose now that δ satisfies $\delta \leq k$. When will the firm Comply and when will it Ignore the threat? Rewriting $\bar{\delta}$ with $a = 1$, we get $\bar{\delta} = \frac{A(4-3\sqrt{2})}{4} + k$, which is less than $\tilde{\delta} = k$. According to Proposition 1.6, when $\delta \leq \frac{A(4-3\sqrt{2})}{4} + k$, there will exist a unique cutoff $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$ the firm Ignores.

Suppose $\delta \leq \frac{A(4-3\sqrt{2})}{4} + k$ and we know there exists a unique cut-off $\hat{w}$ that divides the firm's action between Comply and Ignore. One can solve for $\hat{w}$ for two scenarios: the first scenario is when the profit of Ignore satisfies the inequality $\pi_i \geq \pi_c(\underline{w})$ and $w^* \leq \underline{w}$. The second scenario is when the profit of Ignore satisfies the inequality $\pi_i \leq \pi_c(\underline{w})$ and $w^* \geq \underline{w}$. For each scenario, there exists a cut-off $\hat{w}$ beyond which the firm will ignore and take the demand hit rather than comply. Let's see how applying $a = 1$ simplifies our results presented in the previous subsection.

Applying $a = 1$ to Proposition 1.7, we get a condition for δ that will give us a unique cut-off: when δ satisfies $\delta \leq (1 - \frac{2\sqrt{2}}{3})(A + k)$, we are in Scenario 1 and there will exist a unique $\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore. Here, if we write out $\bar{w}$, it is $\bar{w} = \frac{A-3k}{4} + \frac{\sqrt{\delta(2A+2k-\delta)}}{4}$.

Another unique cut-off occurs when δ satisfies $(1 - \frac{2\sqrt{2}}{3})(A + k) \leq \delta \leq \bar{\delta}$ or $(1 - \frac{2\sqrt{2}}{3})(A + k) \leq \delta \leq \frac{A(4-3\sqrt{2})}{4} + k$. We are then in Scenario 2 and there will exist a unique $\tilde{w} \geq \hat{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \tilde{w}$ the firm will comply. For

$\hat{w} \geq \tilde{w}$ the firm will Ignore and $\tilde{w} = \dfrac{(\sqrt{2}-1)A + \delta - k}{\sqrt{2}} > \underline{w}$.

If, on the other hand, $\dfrac{A(4-3\sqrt{2})}{4} + k \leq \delta \leq k$, then for all $\hat{w} \in [w_l^*, w_h^*]$, the firm will comply. If $\delta \geq k$, then the firm will either comply or move. That is, suppose $\delta \geq \tilde{\delta}$ or $\delta \geq k$. If given a choice between Ignore and Move, the firm will Move ($\pi_i \leq \pi_h$). Then we can focus on the decision between comply and ignore.

Applying $a = 1$ to proposition 11, we can see that there will not exist a unique cut-off cutoff $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies and for $\hat{w} \geq w^*$ the firm Ignores. This is because $-4a^3 + 5a^2 - 4a + 4 \geq 0$ for $a = 1$.

So we can conclude that when $\delta \geq k$, the firm will always comply to the boycott threat demanding $\hat{w} \in [w_l^*, w_h^*]$. That is, because the there is no technological edge in region h, it will be actually beneficial for the firm to Comply and produce in a lower average wage region.

1.3.5 Analysis when $a = 1, A = 2, k = 1/3$

Now we go over the model and analyses when $a = 1$, $A = 2$, $k = 1/3$ (note here that this satisfies $\dfrac{(A-2k)}{3} \leq \dfrac{A}{4}$, or $A \leq 8k$) and predict the behavior of the firm with respect to δ. The two regions have the same productivity but different local average wage levels specified as $w_h = w_l + 1/3$.

Solving the maximization problems of each region, the optimal amounts of employment are: for the high region, $L_h^* = \dfrac{2}{4}$ and for the low region, $L_l^* = \dfrac{2+1/3}{4}$. The firm's respective profits will be $\pi_h(L_h^*) = \dfrac{4}{8}$ and $\pi_l(L_l^*) = \dfrac{(2+1/3)^2}{8}$. The corresponding wage level at each region will be $w_h^* = \dfrac{2}{4}$ and $w_l^* = \dfrac{1}{4}$. The

price of good charged to the consumer if firm produces in h is $p_h = \frac{6}{4}$ and in l, $p_l = \frac{6 - 1/3}{4}$. Since the low wage region yields greater profits than the high wage region, the firm will always initially produce at l, paying the wage $w_l^* = \frac{1}{4}$ and setting the price at $p_l = \frac{6 - 1/3}{4} = 1.417$. (Note here that $\underline{w} = \frac{A - 2k}{3} = 0.444$.)

The $w_l^* = \frac{1}{4}$ is known and the C type consumers demand $\hat{w} \in [\frac{1}{4}, \frac{2}{4}]$ for the workers. What will be the firm's response? Let's first calculate the values $\tilde{\delta}$ and $\bar{\delta}$, plugging in $a = 1$, $A = 2$, $k = 1/3$: we get $\tilde{\delta} = k = 1/3$ and $\bar{\delta} = \frac{A(4 - 3\sqrt{2})}{4} + k = 0.212$.

According to Proposition 1.5, when δ satisfies $\delta \leq 1/3$, it is more profitable for the firm to Ignore than to Move. That is, if the fraction of Caring individuals becomes greater than $1/3$, the size of the demand cut is too large for the firm to bear, and it will choose to relocate to h rather than to ignore and stay in l.

Let's now look at the decision between Comply and Ignore. Proposition 1.6 tells us that when $\delta \leq \bar{\delta}$ or $\delta \leq 0.212$, there exists a unique cutoff $w^* \in [\frac{1}{4}, \frac{2}{4}]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$, the firm Complies. When $\hat{w} \geq w^*$, the firm Ignores.

Let's study the $\delta \leq 0.133$ case first. Applying $a = 1$, $A = 2$, $k = 1/3$ to Proposition 1.7, we get a condition for δ: $\delta \leq (1 - \frac{2\sqrt{2}}{3})(A + k)$ or $\delta \leq 0.133$, which gives us a unique $\bar{w} = \frac{1}{4} + \frac{\sqrt{\delta(4 + 2/3 - \delta)}}{4}$ such that for $\hat{w}$ satisfying $\bar{w} \leq \hat{w}$ the firm will Comply. For $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$ the firm will Ignore. This corresponds to scenario 1.

Another unique cut-off occurs when δ satisfies $(1 - \frac{2\sqrt{2}}{3})(A + k) \leq \delta \leq \bar{\delta}$ or $0.133 \leq \delta \leq 0.212$. Then we are in scenario 2 and there will exist a unique $\tilde{w} = \frac{(\sqrt{2} - 1)2 + \delta - 1/3}{\sqrt{2}}$ such that for $\hat{w}$ satisfying $\tilde{w} \leq \hat{w}$ the firm will comply.

For $\tilde{w} \geq \hat{w}$ the firm will Ignore.

When $\bar{\delta} \leq \delta \leq \tilde{\delta}$ or $0.212 \leq \delta \leq 1/3$, then for all $w^* \in [\frac{1}{4}, \frac{2}{4}]$, the firm will Comply.

What will happen when $\delta \geq 1/3$? We have shown in the previous section that there will not exist a unique cutoff $w^* \in [w_l^*, w_h^*]$ for $\hat{w}$ such that if $\hat{w} \leq w^*$ the firm Complies and for $\hat{w} \geq w^*$ the firm Ignores. (This is because $-4a^3 + 5a^2 - 4a + 4 \geq 0$ for $a = 1$.) That is, for all δ that satisfies $\delta \geq 1/3$, the firm will Comply.

To sum up the above results: for $\delta \leq 0.133$, there exists a unique $\bar{w} \leq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \bar{w}$, the firm will Comply. For $\hat{w} \geq \bar{w}$ the firm will Ignore. (This corresponds to scenario 1.) Total welfare is maximized at $\hat{w} = \bar{w}$.

For δ satisfying $0.133 \leq \delta \leq 0.212$, there exists a unique $\tilde{w} \geq \underline{w}$ such that for $\hat{w}$ satisfying $\hat{w} \leq \tilde{w}$, the firm Complies. For $\hat{w} \geq \tilde{w}$ the firm will Ignore. (This corresponds to scenario 2.) Total welfare is maximized at $\underline{w}$, which is less than $\tilde{w}$.

For δ satisfying $0.212 \leq \delta$, for all $w^* \in [\frac{1}{4}, \frac{2}{4}]$, the firm will Comply. (This corresponds to scenario 3 and 4.) Total welfare is maximized at $\underline{w}$.

1.4 Discussion

Subsection 1.4.1 applies the framework developed above and discusses the Indonesian example from the Introduction section. In subsection 1.4.2, I discuss transnational activism in general in relation with product boycotts previously discussed.

1.4.1 Discussion - Indonesian Example

Let's now go back to the Indonesian example of Harrison and Scorse (2006) presented in the introduction. In 1989, the US government (lobbied by the AFL-CIO and other labor NGOs) threatened to withdraw special tariff privileges for indonesian exports if Indonesia failed to address human rights issues. As a response, the government mandated minimum wage quadrupled and combined with the anti-sweatshop activism by the Northern NGOs, the real wages for unskilled workers in large foreign-owned textiles, footwear, and apparel exporting plants significantly increased.

With the increase in minimum wages, aggregate manufacturing employment decreased, but Harrison and Scorse (2006) did not find any significant additional impact to the employment of the firms that were exposed to consumer activism. That is, firms faced with boycott campaigns and government's minimum wage increase raised the wages and employment went down. The wage increase, however, was greater than those faced with only the pressure from the government, the cut in employment was not any more. Moreover, the targeted firms did not show exits.[15]

Let's now analyze the welfare effects of such consumer activism using the model presented in the previous sections. I have shown that the welfare consequences depend on where the target wage $\hat{w}$ lies relative to $\underline{w}$. Here, even though in case of Indonesia there were forces other than consumer activism that increased the wages, for this exercise let us assume that boycott activism was the sole source of wage rise. Or we could assume that the government only

[15]Harrison and Scorse speculate that this may be because of the specific period of data coverage - 1990 to 1996 was a period when the garment industry expanded. Since then a lot of plants have relocated to Vietnam and China.

provides the guideline and the activists pressured for compliance. Then the threat could be thought of as the following: "if you do not comply to minimum wages set by the government, I will not purchase from you." Given this threat, the firm did raise the wages and employment did go down.

From the fact that increase in minimum wages resulted in a decrease in employment, we can conclude that the boycott activism has decreased employment. This indicates that $\hat{w} > \underline{w}$. And since the firms did not close down, we can conclude that we are in Comply 2 where the firm complied with the demands. Is welfare maximized? No, because as $\hat{w}$ increases beyond the point of $\underline{w}$, the welfare started to decrease. Employment went down and the price that consumer faced started to go up. The wage increased beyond the point where the total welfare would have been maximized.

1.4.2 Discussion - Transnational Activism

One can think of transnational activism in general using the results of the welfare analysis. As Ali (1996) and Seidman (2007) have pointed out, consumer campaigns carry the risk of giving the power to the consumers and not to the workers in making decisions about which labor rights matter and which factories should be targeted. Moreover, consumers take no responsibility for the outcome of the campaign: when a plant closes down, it is usually the workers who have to bear the cost. Let's give the benefit of the doubt to the activists and assume that the goal of a boycott campaign is indeed to increase the welfare of the workers in the developing countries. To make the firm stay and comply with the wage increase demand, such unintended consequences should be

looked out for.

The risk of a boycott backlash comes directly from two kinds of asymmetry of information: one between activists and workers, and another between the firm and activists. Lets examine each in detail.

There has been research that addresses the information asymmetry between activists and workers and its consequences. The needs of the workers are not known or they are considered less important to the activists. In 1994 after visiting apparel factories in Honduras to investigate labor rights violations, US labor rights NGOs conducted campaigns against child labor of the US owned firms (Anner, 2002). When all under-aged workers were dismissed in response to the protests, Honduran unionists were in dismay: there was no outside option for those households in which child labor was inevitable to make ends meet, and the unions' most important concern of obtaining the right to organize (which they had appealed to the NGOs) were not addressed at all. The actions of the NGOs not only were ineffective but also turned out to be harmful.

The second asymmetry information between the firm and the activists is tied directly to the welfare analyses in previous sections. As this work implies, the highest minimum wage that the activists can demand of the firm without it shutting down or ignoring the threats and thus lowering the wage even more depends on the estimated population of the boycotters, differences in average wage levels and relative productivities of production locations. The firm has information about potential production locations, their productivity, and wages that will be paid. If such information is not known (due to lack of resources) then actiivsts will not know how far they can push their demands.

One way to deal with such asymmetries may be through "brokerage" (Tarrow, 2006, p. 190), the creation of linkage between previously unconnected actors and the mediation of the relation. Brokers can facilitate collaboration and direct communication between organizations. In the boycott framework, an intermediate actor (usually an NGO such as the Clean Clothes Campaign) will collect credible information of the labor market conditions. Transferring information between the workers and consumers (potential boycotters) (Keck and Sikkink, 1998, p. 226) the brokers can help set a goal that can resonate with both.

In order to resolve the asymmetry of information between the firm and the activists, brokers could again collect information of the different labor markets and help tailor the activists' demand. Closing the information gap between the firm and the activists, however, may be harder. Moreover, there also maybe situations when there is no way that the firm can stay in a region given the profitability prospects. When different production regions have the same productivity ($a = 1$ case in subsection 1.3.3) the firm always has an incentive to produce in a region with the lowest labor cost. Therefore, to attract capital, subcontracting firms may lower their wages further, which will lead to a race to the bottom. Anner (2002, p. 18) presents a case of brazilian autorworkers supplying for Ford. When the workers flew to Detroit to protest against the firms closing down in Brazil, the US United Autoworkers Union (UAW) that collaborated previously with them did not offer any help. For the UAW, either the Brazilian jobs or their jobs had to go. The outcome could have been different if groups such as the International Confederation of Free Trade Union played a role of the broker and linked the production sites and encouraged the workers to act collectively.

1.5 Conclusion

Information plays a role not only in mobilizing consumers (Della Porta, 2007, p. 13) but also in setting the most effective goals which can lead to a successful campaign. This paper is an attempt to capture such importance of local and global market knowledge in a tractable model. Activism by the consumers who have the power to change the behavior of the firm through boycott campaigns may actually result in a reduction in welfare of the workers when the firm decides to alter its operation by lowering the wage further expecting a demand decrease (Ignore) or by shutting down and moving elsewhere (Move).

The model shows that depending on parameters δ (number of caring individuals), k (difference in average local wage level), and a (the difference in productivity between the possible production regions), firm's response with regards to boycott activism is determined. An interesting result from this setup was that depending on $\hat{w}$, even when the firm complies, it may have negative welfare consequences to both the consumers and workers.

An interesting extension for another paper would be to investigate different scenarios regarding the timing of the announcement of $\hat{w}$. Here in my framework, $\hat{w}$ is known prior to the first stage where the firm decides where to produce. Suppose that the firm knows $\hat{w}$ and also that the caring consumers will protest based on previous direct or indirect experiences of subcontracting. Even if the expected profit of producing in region l is greater than the expected profit of producing in h, the firm may not enter l in the first place if the firm fears of a boycott that may incur losses. That is, suppose $\pi_l^* > \pi_h^*$. Then in the previous analyses, the firm should be choosing region l over h. But if the firm rationally

expects a boycott movement demanding $\hat{w}$, which lies between the equilibrium wages of the low region and the high region ($w_h^* > \hat{w} > w_l^*$), and if staying in l is expected to yield less profits than producing in h, ($\pi_h^* \geq \max[\pi_c, \pi_i]$), the firm will choose h to start with and stay there through-out.

A more realistic stylization would be a situation where firm knows the distribution of $\hat{w}$, and only after it starts producing in either of the region, $\hat{w}$ is revealed. The firm has a distribution of $\hat{w}$ in mind from previous experiences of subcontracting. Depending on the expected pay-offs, the firm may enter l and exit to h after the $\hat{w}$ is realized, the firm may never enter l, or may enter l and stay, either complying to or ignoring the boycott threat.

The result suggests that activists set their goals by studying the labor markets and coordinating with local groups rather than demanding what may seem "righteous'. This is particularly true for transnational activist groups, transnational social movement organizations, and Northern trade unions which may follow a more is better strategy in the absence of detailed information about local conditions in the countries of the South in which exploited workers are employed. Brokers such as transnational advocacy network and transnational labor networks could facilitate communication and collaboration.

CHAPTER 2

SOLIDARITY OR COMPETITION?: A TALE OF TWO UNIONS

2.1 Introduction

In February 2007, the South Korean Congress passed a Non-regular Workers Protection Act which required the firms to guarantee regular status to temporary workers[1] of more than two years. The percentage of non-regular workers in the country was increasing rapidly (doubling from 17% in 2001 to 29% in 2005, which was the second highest of all OECD countries[2]) and the government was attempting to reverse the trend. The Act, however, aroused vehement opposition from labor activists and scholars. There was no legal restraint to prevent abuse of the law by the businesses: not only could the firms choose outsourcing to avoid responsibility over employment and effectively lower the wage, they could fire the temporary workers or allow their contracts to lapse, before the law was to go into effect in July 2007.

The response of the firms diverged, some upgrading the contracts and the others choosing to lay off workers. One firm took an extreme measure: the E-land Group, a conglomerate ranked 26th in the country in revenue size, let go more than 700 non-regular workers from its retail stores Homever and Newcore

[1]There is no consensus in drawing the boundary of non-regular (or temporary) work: depending on what definition one uses, the percentage of non-regular workers in South Korea in 2005 ranged from 29.1% to 47%. I use the definition that is consistent with the OECD definition of non-regular employees which results in the figure 29.1%: "workers under fixed-term contracts, those who do not expect their jobs to last for involuntary and non-economic reasons, temporary agency workers, and on-call workers." (Grubb et al., 2007, p.16 p.17) Controlling for job characteristics, the estimated wage gap between regular and non-regular workers can range from 5% (Nam et al., 2005) to 19% (Ahn, 2004). I use the term temporary and non-regular workers interchangeably in this paper.

[2]There may be measurement errors in these figures which presents a possibility that the increase is amplified. For a detailed explanation, refer to (Grubb et al., 2007, p.19).

Outlet in April and May of 2007. In response, the E-land General Labor Union (EGLU) and the Newcore Labor Union (NLU) - the respective unions of the employees of the subsidiary firms - joined forces to protest against the mass dismissals in June 2007.

With an announced strategy of "collective struggle, collective negotiation, collective agreement," the two unions coordinated protests and shared finances and tactics. The protesters were framed as female cashiers in their 30s to 50s who earned approximately 800,000 Korean Won ($800.00 US) a month working 8+ hours a day sometimes without a single break for six hours. The pictures of "our mothers" lying down on the store floor arm in arm resisting against the riot police was powerful enough to draw great sympathy from a public hostile to labor strives. The protest went on to take over the annual National Summer Struggle of Labor as various interest groups, enterprise unions, the national labor party, and national-level trade unions came together and supported the protesters.

As time went by, however, protests that had been led by over a thousand people were shrinking rapidly as strikers started to cross the picket-line or went on to different jobs. By the end of 2007, the media and the public were no longer interested, and NLU's and EGLU's umbrella organizations Korean Confederation of Trade Unions (KCTU) and Korean Federation of Private Service Workers' Unions (KPSU) had left the protest sites. By June 2008, there were only fifty to sixty strikers at most in each union's protests.

The most unexpected development was the estrangement of the NLU and the EGLU; the Common Headquarters remained in name only and the members of the two unions completely ignored each other at solidarity strike sites

for other enterprise unions. Divergence in tactics and membership characteristics were the oft stated reasons why they were no longer collaborating. This chapter will explore whether there were any other reasons to the split. I examine how the coalition of the EGLU and the NLU initially formed against the E-land Group despite their organizational differences and how it was weakened after three months.

I argue that political opportunities combined with change in objectives with the progression of negotiation shaped the processes of coalition formation and dissolution. In June 2007, both unions shared the goal of starting negotiations with their common unrelenting target. Support from the government and the public was vital in bringing the firm to the negotiation table. As the EGLU's claims gained salience, the NLU had an incentive to frame their issues in terms of that of the EGLU and join forces. The alliance was mutually beneficial: there power in numbers and the EGLU benefited from the NLU's strong finances.

As the strike continued, however, differences in contributed resources and diverging membership characteristics began to generate tension within the coalition. When the Group responded to the unions and to their goals asymmetrically, the two started to clash over tactics and operate independently. Even after both unions failed to come to an agreement with their respective firms at the end of September 2007, the widened rift between the two unions could not be bridged.

The remainder of this chapter is laid out as follows. In Section 2.2, I review the literature on coalition formation and dissolution. Section 2.3 describes the data collection method and Section 2.4 reviews the pre-2007 history of the EGLU and the NLU. In Section 2.5, I describe the coalition formation and in Section

2.6, its dissolution. Section 2.7 provides a discussion of the process and Section 2.8 concludes. In the appendices I propose a game theoretic framework that explains the coalition formation mechanism.

2.2 Theory of Coalition Formation and Dissolution

According to Tilly and Tarrow (2007, p. 216), coalition formation is a "creation of new, visible, and direct coordination of claims between two or more previously distinct actors." Resources are shared, but individual organizational identities are generally preserved (Zald and Ash, 1966, p. 335). Not only is there a sharing of costs in such an arrangement, there are positive externalities[3]: through increased numbers of participants and broader coverage of individual characteristics such as age, sex, and socio-economic status, a coalition can give justification of the pursued goals and draw more external financial and political support (McCammon and Campbell, 2002; Hathaway and Meyer, 1997; Tarrow, 1994). Intangible resources such as tactics and leadership can also spill-over within a coalition.

Coalition formation is not without costs. The original goals of organizations may be marginalized (Hula, 1995; McCammon and Campbell, 2002) and as with any collective action there will be free-riding. When a coalition becomes too big, maintenance may become an issue because it takes time and energy for individual organizations to coordinate (Staggenborg, 1986). Moreover, organizations may face new opposition because of their partners in the alliance (McCammon

[3]Meyer and Whittier (2004) finds that the ideas, tactics, style, participants and organizations of one movement often have a spill-over effect on other social movements. Such way of thinking can be applied to organizations within a coalition

and Campbell, 2002).

When the benefits exceed the costs, organizations will build a coalition (Levy and Murphy, 2006; Zald and Ash, 1966). For example, a coalition may arise when there are political or environmental opportunities, new threats to organizations' goals, or commonalities in interests and ideology which can be a basis of a mutually acceptable coalition frame (Croteau and Hicks, 2003; Levy and Murphy, 2006; McCammon and Campbell, 2002; Mayer and Brown, 2005; Meyer and Corrigall-Brown, 2004; Meyer and Whittier, 2004; Staggenborg, 1986; Van Dyke, 2003). Some researchers have found that during a period of resource abundance coalitions are more likely to be formed (Staggenborg, 1986; Van Dyke, 2003; Zald and McCarthy, 1987), while some others have found the opposite (McCammon and Campbell, 2002).

Once a coalition is formed, cooperative differentiation (Hathaway and Meyer, 1997; Staggenborg, 1986), a stable source of external funding and aid, and ideological compatibility (Staggenborg, 1986) can help sustain it.

While the existing literature has focused on the absolute levels of external and internal factors such as political opportunity, threats, and resources of the organizations in the potential coalition, it is also useful to examine the relative levels of these factors within the relationship. It is rarely the case that the involved organizations have identical features or that one organization has higher levels of all characteristics than the other. That is, even though collective action by itself can exercise greater power toward a common target simply by increasing the number of participants in a movement[4], from an organizational

[4]Not only are social movement organizations that work in coalition more likely to achieve their goals, mass mobilizing is "one of the few ways that social movements are able to exercise power" (Van Dyke, 2003).

perspective, whether the other organization is politically, or socially more (less) favored or has more (less) resources will matter in its decision to join forces. When organizations perceive that their quantitative and qualitative differences are complementary to meeting their goals, a coalition is more likely.

When we start thinking about the organizational characteristics in such relative terms, several benefits of coalition formation emerge. First is the spill over of political opportunities. When the claims of an organization gain salience, others can free-ride on the generated support either by framing their issues in similar terms or by forming an alliance so as to be identified with the group facing a conducive environment. This is especially true for interest groups whose main activity is public protests and who rely on societal support.

Tactical differences among organizations can also be an attraction when considering a coalition. The modularity of tactics (Tilly and Tarrow, 2007, p. 23) will provide the organizations with an expanded "tool box" to work from at various stages of the claims-making process.

The benefits associated with coalitions, however, cannot always maintain a coalition. While the lack of resources can be a draw for an organization to join forces with others, it can also invoke sense of depravation during common activities and can lead to resentment. Finances are not fully shared unless it is a merger: organizations exist to promote their own interests and are concerned with their maintenance *after* the protests. Even if finances were to be shared completely, the organization that contributes more resources might feel that they are not getting enough credit, and the one contributing less might think that the richer group was not contributing enough.[5] Differences in organiza-

[5]This links to Staggenborg (1986)'s point that for a long-lasting coalition organizations have to be accepting with different amounts of contributions.

tional tactics can have negative consequences as well because diverging protest styles can be a source of dispute. To an organization that employs violent tactics and thinks moderate activism is not enough to achieve its goals, groups that use relatively temperate methods will seem like free-riders.

Such conflict may hinder formation of a collective identity and weaken the coalition. Diani and Bison (2004) suggest that collective identity facilitates cooperative engagement in social and political conflict together as a group.Dixon and Hodson (2003) find that union organization facilitates protest only to the extent that "it builds on strategies, practices, and solidarities already developed on the shop floor." Shared identities and/or the absence of significant identity differences between groups facilitate coalition formation (Van Dyke, 2003). In an ad hoc coalition or in an event coalition, identity differences may be less relevant (Van Dyke, 2003, p. 228), but for a lasting coalition the "solidarity benefit of friendship" can be a key factor (Hathaway and Meyer, 1997). Especially in situations where the main coalition activity is shop floor-based protests, a collective identity may be important for sustaining the cooperative relationship.

A coalition without a strong collective identity may not be able to withstand changes in external circumstances (for instance, the firm's or state's asymmetrical treatment). When the decision maker uses disparate strategies on the different organizations in the coalition, their optimal responses are likely to diverge. For coalitions built on common activities, this is likely to be a coalition-breaker. There is a possibility of cooperative differentiation (Hathaway and Meyer, 1997; Staggenborg, 1986) but without a collective identity linking the organizations, a sustained collaborative relationship will be difficult.

It may also be the case that the objectives of the protest change over time and

it is optimal for an organization to form and break alliances depending on its stage in the claims-making process. Claims-making consists of two elements: the process, or the making, and the actual claims. The distance between the claims and the status quo affect how much effort the process entails. But for a labor dispute that involves negotiation with an oppressive and unwilling firm or state, the process can often be divided into two stages. The first stage is the period up to the beginning of the negotiation, and the second stage is the negotiation itself. The issues of concern to the organizations remain more or less the same throughout, but the organizations' immediate interest during the first stage is getting to the negotiation table and the specifics of their claims are relatively unimportant. At this stage, because of the benefits described above, alliances are likely to emerge. Once the coalition succeeds in pressuring the target and negotiations begin, organizations generally operate independently because agreements are drawn separately. This stage tend to be institutionalized when the first stage is not. Now, cooperative relationships are still possible, and can be useful, but there is not as strong an incentive to bind the organizations together.

In summary, in addition to the leverage that a committed collective action brings against a common target, differences in quantity and quality of resources and diverging membership characteristics can act as a *draw* for short term or event coalitions[6]. Such differences, however, can impede formation of a collective identity. When the rate of progression differs across organizations within a coalition, tension may build up and without a collective identity it will be hard for the coalition to persist. It may also be inherent to the the claims-making process that once the decision maker starts to respond it is beneficial for orga-

[6]A term coined by Levy and Murphy (2006)

nizations to break up. With such framework in mind, I look at the coalition formation and dissolution of the two main actors - the E-land General Labor Union and the Newcore Labor Union - of the 2007 non-regular workers movement in South Korea. A labor union is not intrinsically a social movement organization, a "complex or formal, organization that identifies its goals with the preferences of a social movement or a countermovement and attempts to implement those goals" (Zald and McCarthy, 1987, p. 20), but it can be thought of as one in situations where the union initiates a social movement or becomes a part of one. This was the case for the EGLU and the NLU for the non-regular workers' movement in 2007.

2.3 Methods of Research

I have used two ways to explore the mechanism behind the formation and dissolution of a coalition between the two labor unions, the EGLU and the NLU. First, I went through the Korean Integrated News and Database System from 1993 (when the original E-land Union was first conceived) to August 2008. Most articles related to the unions were concentrated in 2007 and 2008, when the actual coalition formation took place.[7] The database consisted of articles from 20 online and offline newspapers. Since I have reconstructed the actualities of the strike based on all newspapers (for example, the announcements of unions/government/E-land group at a specific period of time, the issues of conflict, and the occurrence of protest in size and intensity) the diverging political spectrum of the papers was helpful. Other documentary data include newsletters, internal communications, and daily protest activity logs available on the

[7] About 4000 articles

union's website[8] since 2007.

The second method was actual field research that consisted of structured interviews in person, over the phone, and through email from March 2008 to August 2008, and participation in official meetings and protests in May and June of 2008. I had discussions with multiple members and the leadership of both unions, the organizers of the National Labor Party that supported the protests, strategic administrators of the umbrella organization KPSU, social movement researchers, civilian participants, and journalists that have been following the movement for over a year.[9]

2.4 History of Coalition

Before discussing the 2007 coalition, it will be useful for us to trace the history of the two unions and their brief interaction in 2006 - a loose coalition that was short-lived. The two claimants in the 2007 E-land struggle were the Newcore labor union (NLU) and the E-land General Labor Union (EGLU). In 2006, there were three labor representations based in the E-land Group: the NLU, the (original) E-land Union (ELU) and the Carrefour Union (CLU). In May 2006, the E-land Group acquired sixteen Carrefour hypermarket stores and the ELU and the CLU merged in December 2006 to become the EGLU. A triad merger was initially pushed for but was unsuccessful due to strong objections from the members of the NLU. The NLU differed from the other unions in membership characteristics such as age range and employment status, in resources, and in

[8] http://elandilban.ba.ro

[9] Even though I did not have a chance to talk to the management of the E-land Group, it should not matter much since its moves were well-documented. Of course, I can only speculate on why they have made such decisions.

its position within the E-land Group.

Founded in 1998, the NLU represented the workers from Newcore, a department store-turned-outlet bought by the E-land Group in Dec 2003. Newcore originally was a union shop of regular workers who were mostly young women and men in their twenties and thirties. The union had lived through grueling restructuring, default, and acquisition processes that led to a strong organizational structure. By the end of 2005, NLU had stable finances and enjoyed a certain preferential treatment in the E-land group due to having one of the most profitable stores (Kangnam Newcore).

The ELU, the official labor union of the E-land Group, had only fifty members in 2006. It was founded in 1993, but the Group took four years to recognize it as a valid negotiation partner: only after fifty-seven days of striking in 1997 did they reach a collective bargaining agreement that guaranteed wage payment during leave. In 2000, after two-hundred sixty five days of striking, it achieved improvements in working conditions. Monthly wages of full time non-regular production workers increased from approximately 400,000 Korean Won to 560,000 Korean Won ($400 to $560 US dollars) and those with three years or more of job tenure were to be promoted to regular status. A consensus was reached that unilateral layoffs and contract lapses were not to occur again. The strike of the ELU in 2000 and 2001 was referred to by the labor as the first significant non-regular workers' struggle in South Korea. Despite the successful outcome of the negotiations, however, the long lasting strife left the organization with a mere fifty members at the end of 2001.

The CLU was the labor union of the Carrefour Hypermarket. The workers' fear of unemployment in the acquisition process had led to a sharp increase in

membership in 2006. About twenty percent of the total workers were union members and more than half of them were non-regular workers, mostly female and in their thirties, forties, and fifties. The CLU had succeeded in reaching a collective agreement with the Carrefour management that specified the future acquiring firm to recognize the labor union and to guarantee continued employment of all workers. It also included a clause that prohibited terminating the contracts of non-regular workers of more than eighteen months.

In May 2006, all three unions were striking against the E-land Group. The NLU's claims centered on two issues: a change in wage structure and freedom of union activities. The NLU was in the middle of its annual wage negotiation (Im-dan-hyop) period and was protesting against the firm's proposal of introducing a yearly salary system for (regular) workers. This meant that individual wages will be negotiated every year depending on one's performance evaluation (which was subjective) rather than job tenure. Harassment of union members was also an issue. The firm had recently called in over 900 union members for "disciplinary" purposes to dissuade them from participating in union activities.

For the ELU, the firm's circumvention, distortion, and finally a renege of the collective agreement in March 2006 fueled the protests. Park Sung-soo, the founder and the current CEO of the E-land Group and a devoted Christian had famously said that "There is no labor union in the Bible." The group ignored or evaded the Collective Agreements of previous years and other labor regulations, and union members were openly disadvantaged in promotion. For instance, even though automatic rehire was guaranteed by the Collective Agreement, workers were forced to go through the recruitment process all over again

once their contractual period was up. On March 6th, the Group notified the ELU that the Agreement negotiated in 2001 and annually renewed since then would be terminated since it did not reflect the "changes in socio-economic circumstances, the law, and business environment" (Labor Today, 2006-08-31). The Group thought having to secure the employment of the temporary workers was too restrictive to its business.

During this time, the CLU was in the middle of an acquisition turmoil and wanted the E-land Group to guarantee that it would respect the Collective Agreement drawn between Carrefour and the Union. The Group declined to give a definite answer which fueled the frustration of the CLU members.

Faced with the same uncooperative firm around the same time, the three unions formed a "Common Headquarters of the Strikers" (Kongdong-tujaeng-bonbu). In addition to coordinating protests, they also started to work with each other towards a merger. Even though the unions were based at different subsidiary firms, the Group had such centralized power over the management of all its subsidiaries that it was "only natural" to have a unified labor representation (Interview 1,3).

But the coalition was not a strong one: looking back, one of the union executives from EGLU admitted that the common headquarters in 2006 was of a top-down talk driven one pushed mainly by the union executives and had failed to involve the union members (Ohmynews, 2007-09-30). Collective strikes were small and rare.

The NLU reached an agreement with the Group in July 2006 and remained in the coalition in name only. After that, there were few attempts at collective

action between the ELU and the CLU with little success. In December 2006, the ELU and the CLU merged and formed the EGLU without the NLU. The two were both weak and a formal merger was a way of pooling their resources and revitalizing the organization.

2.5 Coalition Formation

A major concern in labor at the beginning of 2007 was the Non-regular Protection Act to be voted on in February 2007. According to the law, not only would the employer have to upgrade non-regular workers of two years or more to regular status, it would become explicitly illegal to pay differential wages depending on one's employment status. Of course there was no legal restraint to prevent the misuse of the law by businesses: firms could outsource the jobs to avoid responsibility over employment and effectively lower the wages. They could also fire or lapse the contracts of the non-regular workers before the law was to go into effect in July 2007. Even though such points were raised by unions and labor scholars, the law was passed by the government in February and went into effect in July as scheduled.

The E-land Group responded to the law exactly as predicted. In late 2006, contracts for non-regular workers were shortened for easy firing. Homever, (former Carrefour, where most EGLU members worked) which had followed the 3-6-12 system, changed the schedule to a 3-6-6 one. Originally, after the initial 3 months of a contract, the employee would get a 6-month contract which was followed by a 12-month one. By the end of 2006, the non-regular workers expecting a 12-month contract were faced with a 6-month one instead. For New-

core (where most NLU members worked), the original 6-month contract was shortened to a 3 month one. After the final 6 months (for Homever) or 3 months (for Newcore) the contracts were lapsed. Newcore, in addition, started to use a zero-month contract that did not specify a fixed contractual period. Before the Protection Act went into effect in July 2007, over seven hundred non-regular workers from Newcore and Homever were laid off in April and May. The goal of the two unions - maintaining and improving the welfare of the workers - was being threatened.

In March 2007, again under the name of the Common Headquarters of the Strikers, the NLU and the EGLU united their forces to protest against the mass dismissals. The common headquarters announced a strategy of collective struggle, collective negotiation, and collective agreement, a "mindful gesture" to prevent a recurrence of the firm's divide-and-rule tactics of the year before. The union executives were well aware that when the three unions had struggled together the previous year, the coalition had lost momentum and more or less had dissolved after the NLU came to an agreement with the firm (Interview 4).

The two unions represented distinct groups of people with different claims. For the NLU, it was not the firing of non-regular workers that initiated the strike. Even though the union had succeeded in drawing a favorable Collective Agreement the previous year, the year 2007 had begun badly. In December 2006, after introducing the PDA (personal digital assistant) system in the cash register area of stores, the firm transferred regular worker cashiers to other sections or branches (requiring relocation) without their consent and started outsourcing those jobs. Rumors about selling the profitable Kangnam branch was another point of dispute. The Group was experiencing financial problems from

overstretching itself to acquire 16 Carrefour markets in 2006. Newcore's most profitable store, the Kangnam branch, was on the merge and acquisition market which meant that over a thousand workers would eventually face restructuring. The firm's reassurance that it would oversee the operation even after the sale did not appease the union members.[10]

For the NLU, the dispute over non-regular contracts and the Act were secondary. The union only began to recruit non-regular workers for the first time in April 2007.[11] The acting head of the NLU in June 2008 said, "For us, we made it clear from the start to the union members that this was not a non-regular workers' protest. We were fighting mainly against the forced transfers - the unilateral restructuring that came with the introduction of the PDA system - in December 2006. Employment stability of non-regular workers was only a part of our agenda. The regular workers joined in because there was an understanding that if non-regular workers suffered from job insecurity, then it would be their turn soon." (Interview 3) The regular worker union members were receptive to the influx. For them, protecting the non-regular workers was in line with their other goals since it was a means of protecting their own jobs.

On the other hand, the EGLU's claims were specifically focused on non-regular employment. Of 1,500 union members, more than half were non-regular workers (which is rare for South Korea in general: while the overall union membership is 20%, only 1% of the union members are non-regular workers) whose immediate concern were the employment guarantee. The firm was not abiding by the Collective Agreement from the Carrefour days, which required upgrad-

[10]The firm was supposed to confer with the union a month before merger and acquisition process but it did not.

[11]Interestingly this was after the initiation meeting of the Common headquarters in March 2007.

ing workers of 18 months or more to regular status. In addition, the firm had started to operate 24 hours a day and also on national holidays without any discussions with the union.

The passage of the Non-regular Workers Protection Act and the E-land Group's response to it, allowed the unions to overcome such differences. Moreover, since the first few weeks of the strike was intended to pressure the management of the E-land Group to start negotiating, the exact demands of each union did not matter. To unite against the common opponent, the building of a "consonant frame pyramid" (Croteau and Hicks, 2003; Meyer and Corrigall-Brown, 2004) was important for generating external support as well as for forging internal solidarity. The common headquarters framed the protest as a "struggle for eliminating the discrimination against non-regular workers" and started to pressure the firm. It was "only natural" for the unions to unite against the "exploitative capitalist" (Interviews 1,2,4). The fight, however, was not only directed at the Group. Faced with an unrelenting firm that had no intention of rehiring laid off workers or guaranteeing continued employment for the non-regulars, the unions needed public's and governmental support to change the firm's behavior.

In addition to the negotiating leverage provided by the committed collective action, protesting with many people had emotional benefits. Interviewed members talked of feeling less threatened by the riot police (who were almost always present at protest sites) and the often-violent counter-activist-mobs ("Firm Rescue Force") employed by the firm, when demonstrating with others.

The coalition also increased the strategic capacity of involved organizations through resource spill-overs and sharing. "Office space, staff experience and re-

lationships with authorities and allies" (Ganz 2000; Murphy 2002) were shared and contributed to drawing external support and pressuring the firm.

In addition to the qualitative variation between the unions, the quantitative difference of finances and political and societal support created a mutual incentive to build a coalition. Based in a union shop, the NLU was financially stable while the EGLU was not. The relatively wealthy NLU lent 5,000,000 Korean Won ($5,000 US) to the EGLU at the start of the collective struggle and always paid more than the EGLU for common expenses. The NLU executive estimated that about 50,000,000 Korean Won ($50,000 US) was transferred to the EGLU over the protesting period. The EGLU had an incentive to cooperate with the NLU.

On the tactical front, EGLU's executives were from the former E-land Labor Union, and had experiences of long-term protests against the E-land Group. Moreover, while most of the EGLU members were married, female, non-regular workers of ages ranging from 30s to 50s, the NLU members were mostly single, female regular workers in their 20s who were in general more reserved. The older women of the EGLU had fewer qualms about explosive strikes and led the coalition to receive more media attention.

The diverging membership did not play a role through tactics alone. The public was receptive to the elderly women of the EGLU. Framed as "our mothers in their 30s to 50s who earn approximately 800,000 Korean Won ($800 US) a month (approximately $5.00 per hour), who sometimes work without a single break for six hours," the protesters succeeded in drawing sympathy from a Korean public that is generally hostile to labor strives. The NLU, mostly consisted of young, regular workers whose working conditions were significantly better

benefited from such identity framing.

Starting with a collective protest (the 10th of June), the NLU went on an "indefinite strike" on the 22nd of June, followed an in-house picketing strike conducted by the EGLU (with workers blocking entry and occupying one of the most profitable branches of Homever for fifteen consecutive days) on the 30th of June. NLU soon joined the in-house picketing strike at their own Kangnam branch on July 8th. The public responded by joining the demonstrations outside the stores and boycotting the products manufactured and sold by the E-land Group. When people started to blame the Non-regular Protection Act for the mass firing, the Ministry of Labor also started to exert pressure to the Group. On July 10th the Group agreed to negotiate with both unions.

During the first few weeks at the protests the NLU and the EGLU were indistinguishable from one another: the media acknowledged both leadership together as the Common Headquarters. Interest groups, various enterprise unions, the national labor party, and national level trade unions announced solidarity and supported the cause. The theme of the annual Summer Struggle of Labor became the non-regular contracts and the public participated actively in the protests and product boycotts against the E-land Group. The coalition succeeded in forcing the firm to start negotiating.

2.6 Coalition Dissolution

The beginning of, and progress in, the negotiations did not mean the protests were over. As one officer of the Korean Private Service Workers' Union put it, "Negotiating and protesting concurrently is a strategy unions use. Protest gives

us leverage at the negotiation table" (Interview 4). The protest continued into September.

The Korean Thanksgiving day (August 15th in the lunar calendar, which fell on the third week of September in 2007) is one of the two biggest national holidays of the year. This is when the greatest proportion of revenue is reaped by the distributing companies such as Newcore and Homever. In September, the tide was turning in favor of the E-land workers: if the protest ended before Thanksgiving, the firms could partially make up for the losses they had incurred - estimated at fifty to one hundred million dollars - from sit-in protests and boycotts during previous months.[12] The government had the Annual Inspection of the State Government in October and a presidential election in December. The Minister of Labor, Lee Sang-soo, who was open about wanting to run for Congress the upcoming year, started to pressure the E-land Group for more active negotiations. This was a definite opening of a political opportunity structure for the protesters.

The Group's receptiveness, however, was uneven: while the E-land Group was somewhat responsive to the demands of the NLU, it was adamantly against those of the EGLU. Such divergence originated from the difference in membership characteristics which shaped organizational goals. Even though the overall movement was framed as a non-regular workers' struggle, each union had distinct claims based on their membership.

The NLU's demands in September 2007 were fivefold: 1) elimination of outsourcing with respect to the adoption of the PDA system, 2) reinstallment of regular workers who were involuntarily transferred the previous year, 3) an em-

[12] An informal survey cited by the Daily Labor News (Sep 9th, 2007) estimated about 30% decrease in sales for the E-land Group.

ployment guarantee for non-regular workers of three months or more, 4) rehiring of all the workers that were fired or faced contract relapse after January 2007 and guaranteeing their employment, and 5) withdrawal of all legal charges[13] initiated by the firm against the union members from the sit-in protests. The firm was offering: 1) elimination of outsourcing in within ten months, 2) reinstallment of involuntarily transferred regular workers after individual consultation with administrators, 3) guaranteeing employment for one more contractual term for non-regular workers of three months or more, 4) rehiring of laid-off workers for one more term and trying to employ them continuously, and 5) withdrawal of all charges against the workers but not the union executives.

The EGLU's claims were: 1) re-employment of workers that had been fired since January 2007, 2) upgrading non-regular contracts to regular ones for workers of 18 months or more, 3) employment guarantee for non-regular workers of three months and more, 4) dropping of all charges against the union members initiated by the firm from the sit-in protests. The firm's position was 1) re-employment of fired workers for another contractual period, 2) employment guarantee[14] of workers of 18 months or more but with a different pay schedule than the regular workers, 3) one more contractual period for workers of three months or more, and 4) withdrawal of all charges against the workers but not the union executives.

Once the negotiations began, the firm made it clear that they would be treat-

[13] which was approximately 5,000,000 Korean Won ($5,000 per person)

[14] Employment guarantee was a guarantee of no involuntary layoff and was not a promise of upgrade to regular status. The Group created a new wage - benefit table for such workers : the wage would be the same as that of the non-regular workers, (which was at least 20% less than the regular workers for the same job description) but only with continuing employment. Since before 2007 the non-regular contracts were more or less automatically renewed, what the firm was saying was that it would return to the status quo and distort the intention of the Non-regular Workers Protection Act 's goal of improving the welfare of temporary workers.

ing the unions separately, and the extent to which the Group responded to each union diverged. The negotiations of the NLU and the firm over the clauses such as the elimination of outsourcing and reinstallment of the regular workers who were involuntarily transferred indicates that the Group was more receptive to the demands of the NLU regarding regular worker-related issues. Even though the terms related to non-regular workers were meagerly addressed, the NLU became more willing to compromise as the negotiation continued: by the end of September, there were only approximately 50 non-regular worker members left, compared to 1500 regular workers. Most of the EGLU's members and protesters were non-regulars: there was not much space to compromise when the Group did not want to give up flexibility of temporary employment.

While the negotiations between the E-land Group and the NLU progressed at a fast pace, EGLU had a hard time even scheduling and convening meetings. When the firm made it clear from the start that the EGLU's demands would not be met, EGLU would cancel the scheduled negotiation to go on to a more explosive strike. The EGLU thought that only through protest could they break out of the stalemate. The firm, claiming that the EGLU did not have any intention to engage in negotiations, would then cancel the next scheduled session.

When the firm demanded a stop in protests during the negotiation period, the NLU accepted but the EGLU declined. It was during this time that the coalition between the two unions became weak both at the leadership level and at the membership level. The varying rate of negotiation progressions led to different preferred tactics for NLU and EGLU. The number and degree of independent strikes by the EGLU (without the NLU) increased significantly.

The ultimate point of incoordination within the coalition came on September

16th when the EGLU went into another occupation strike despite warnings from the firm and the government. The NLU, in the process of drafting its agreement with the firm, declined to join the EGLU. Members of the NLU are quoted as saying "Who is going to be responsible (if things go wrong)?" (Interview 4) The penalty for a sit-in protest was too high for the NLU workers at the time when they were finally coming close to a successful agreement. The EGLU alone went on a sit-in protest to be met by the riot police.

NLU failed to come to an agreement in the end because of the non-regular worker-related demands and the firm's intent to punish the union executives. For EGLU, there was not even a negotiation proper : neither side relented from their original positions in the few times the firm and the union actually got together.

After September 2007, the Common Headquarters remained in name only. Even though a collective protest was planned, at Newcore protests E-land General members were nowhere to be seen and vice versa. Members ignored each other when they occasionally crossed paths at solidarity strike sites for other unions. Before September 2007, the Common Headquarters had deliberately pushed the firm to hold negotiations with both unions at the same time in adjacent locations. After September 2007, negotiations became an entirely separate process. The bargaining environment significantly deteriorated for both once Thanksgiving and the State Inspection period were over.

2.7 Coalition Discussion

Was such an estrangement inevitable? I analyze the changes that occurred in those three months that led to coalition dissolution in this section.

Changes in Goals of Protest

In March 2007, the coalition was formed to draw external support as well as to gain leverage from collective action to pressure the firm out to the negotiation table. Political and environmental opportunities for the EGLU spilled over to the NLU and resources flowed in to the coalition from outside as well as being transferred from the NLU to the EGLU. The details of the claims of the unions were relatively less important during this stage.

When the talks began in July 2007, the objective for each organization was to come to a successful agreement reflecting their claims as much as possible. With the struggle dragging on longer than expected, whether this negotiating was done individually or collectively was not important to the union members.

The consonant frame of "struggle for eliminating the discrimination of non-regular workers" that previously facilitated coalition formation was not compelling enough to bring the workers together during this period. The firm and unions to fight over specific clauses in the Collective Agreement and the details of the claims pursued were increasingly important. As an organization mainly composed of regular workers, the NLU was relatively more willing to compromise on the non-regular workers related clauses: for them, protecting the non-regular workers was simply a means to an end of protecting the regular jobs.[15]

[15]The EGLU also have used such logic when it was recruiting regular workers from its workplace. The union, however, was inherently opposed to the interpretation of the non-regulars as shields of the regulars.

The EGLU, on the other hand, mainly were concerned with the instability of non-regular employment.

Varying Progression of Negotiations

With such changes in organizational goals came differences in the rates at which negotiations progressed. In March 2007, the firm was repressive against both unions and their respective demands. Once the negotiations started in July 2007, it became more attentive to the claims of the NLU, willing to compromise on the regular worker-related clauses. The firm led separate negotiations with each union and the sessions with the EGLU were often cancelled.

Since the goal was to reach an agreement in favorable terms, the NLU and the EGLU resorted to different tactics in response to differentiated treatment. While the NLU agreed to stop demonstrating during the negotiation period, the EGLU went on with its own protests. To break the negotiation stalemate, the EGLU planned another sit-in strike in September 2007. Not only did the NLU decline to join in, it rejected the EGLU executives' request to come to the NLU's meeting to persuade the NLU members to participate. Resentment grew within the EGLU: if NLU came to a Collective Agreement and left the coalition it could act as a strikebreaker for the EGLU. Not only would resources coming from the NLU decrease, but the EGLU's bargaining power from collective action would surely diminish.

Asymmetric Finances

From the founding of the coalition the EGLU was financially dependent on loans from the NLU. This gap in organizational resource levels was apparent at protest sites and affected the sentiments of the workers. The issue of lunch

came up in multiple interviews. "When the NLU members ate lunch boxes of 5,000 Korean Won ($5.00 US) value, the EGLU members ate a simple sushi roll (kim-bob) of 1,000 Korean Won ($1.00 US) value. This might not seem like a big deal but imagine this happening every day for three months. This in addition to the fact that NLU members were mostly regular workers when EGLU members were not. ... The apparent difference of status dwarfed the EGLU members' spirits as the protests continued." (Interview 2)

The difference in financial contributions to the coalition also affected both sides. Those interviewed spoke of the frustration that the NLU members felt in not being appreciated and acknowledged by the EGLU or the public. On the other hand, the EGLU members resented that the NLU did not contribute more when they clearly could.

Diverging Membership Characteristics

Each union was a relatively homogenous group in age, sex, marital and employment status. The NLU consisted mainly of young, regularly-employed, single women in their 20s and the EGLU of older, temporarily employed married females in their 30s, 40s, and 50s. The only commonality was their gender. Given that seniority tends to drive the dynamics between individuals in Korea, bonding between people of different age groups would have been difficult. Cultural difference was prominent. The young Newcore women were more reserved and quieter than the older EGLU members. "Because they are young in their twenties, they will just come and sit there, re-doing their make up, watching TV, sending text messages and playing video games on their phones." (Interview 5) From the point of view of the NLU workers, however, "The EGLU women were too violent and fearless, not thinking about the consequences. We

are *different*." (Interview 6) The divergent membership characteristics, in addition to the homogeneity of each group, caused a rift between the two unions as the protests continued.[16]

Since the coalition's main activity was collective protests where all the members physically sat side-by-side almost every day for long stretches of time, the sense of unity or solidarity, the we-ness, among members was important. The unions' asymmetric finances and divergent membership characteristics seem to have hindered formation of a common identity. Even if they had used different tactics in the face of changes in external environment they could have had a closer relationship collaborating with each other. Without a collective identity, however, there was not a room for a cooperatively differentiating coalition.

2.8 Conclusion

In June 2008, the Group announced its plan to sell Homever (EGLU's base firm) to a Samsung Homeplus Tesco, another retailing conglomerate. The NLU, after 434 days of strike, reached an agreement with the E-land group in early September 2008 with significantly worse terms than what had been offered the year before. The NLU not only gave up on all the clauses (in pages 63 and 64) in order to avoid legal charges (which amounted to approximately 10 million US dollars) and the re-employment of the regular workers that were on strike, it also agreed to withdraw its rights to protest until the end of 2010. The 36 cashiers with relapsed contracts were rehired under brand-new contracts without any

[16]David Meyer made an interesting observation that it was actually in the firm's interest to prolong the negotiations to stoke tension between the unions as well as to gain leverage against each union.

employment guarantees.

The EGLU drew out a collective agreement with the Samsung Homeplus Tesco, its new base firm, in November 2008 after 510 days of strike. Unlike the Collective Agreement between the NLU and the E-land Group, they agreed on directly employing temporary workers (no outsourcing) and increasing their wages as well as granting paid leaves. The union members that were fired because of the strike were also re-employed and the legal charges were settled. The labor union in turn withdrew its rights to protest till the end of 2010 and agreed to delegate the wage changes to the firm for a certain period of time. The union representatives voluntarily retired. The Collective Agreement was drawn a month and a half after the Homever hypermarkets were acquired by the Samsung Homeplus Tesco.

Considering the opportunity costs of striking for more than a year, the outcome of the negotiations cannot be said to have been successful especially for the NLU. If the coalition had sustained, could the results have been any different? That is, given that the unions negotiate separately, would a cooperatively differentiating relationship have been beneficial? It does not seem so: the E-land Group entirely lost interest in negotiations after September 2007 and more after December 2007 (when the current "business-friendly" president of the country was elected). The negotiation outcomes achieved by the NLU, which stayed under the E-land Group, were dismal. According to the members of the EGLU, their relatively favorable Collective Agreement was due to their new firm Samsung Homeplus Tesco, which was much more willing to negotiate and compromise. More than anything else, the attitudes of the challenged firms played the decisive role in the negotiation outcomes and it is not easy to see how a loose

sense of coalition could have helped in the negotiation process.

Yet it is interesting to study the coalition dynamics because coalition formation and dissolution are inevitably linked with the life cycle of a movement. With the passage of the Non-regular workers Protection Act and the E-land Group's adverse response, the two labor unions had joined forces and led the non-regular workers movement, which later took over the country's 2007 Annual Summer Struggle of Labor. It is hard to know how much the coalition dissolution contributed to the weakening of the movement. But from a collective-action perspective, the pressure on the firm and to the government definitely decreased when the NLU, consisting of over 1000 union members, began to focus its efforts more on the regular workers' issues with the start of negotiations.

I have examined the coalition focusing on the relative levels of external and internal factors, such as political opportunity, threats, and resources of the two unions. Externally, the comparable threat to their goal - the welfare of the workers - experienced by each union initially drew the two distinct actors together. It was natural for them to join forces when faced with a common opponent that was infamous for its repression of union activities: a committed collective action could provide them a certain leverage against the firm. The specifics of their demands did not matter when the coalition was being initiated because the purpose was simply to bring the Group to the negotiation table. Once the talks convened, however, the focus then turned to the actual claims. The firm was relatively more yielding to the regular employment related clauses which made the NLU's negotiations progress rapidly compared to the EGLU's. Since the goal of each union then became to reach a favorable Collective Agreement with the firm, the separate negotiations were not conducive to coalition maintenance

given such differing status. Moreover, conflict over tactics began to arise: close to coming to an agreement, the NLU was moderate in their protests. In order to break the negotiation stalemate, EGLU went on yet another sit-in strike.

Qualitative and quantitative variations in resources, protest style, and membership characteristics drew the two unions together at first. Not only were there resource sharing and spill-over, the divergent membership characteristics (such as age and employment status) provided the coalition a justification of their protests and resulted in an unprecedented public support. When the protest continued, however, the differences in union and membership characteristics hindered them from building a collective identity.

With no grounded sense of solidarity, the coalition could not withstand the pressure when the Group started to respond to the unions and their claims asymmetrically in negotiations. The structure of the two-step claims-making process - the first leading to the launch of the negotiations and the next the actual negotiations - did not help either. Even after both unions failed to come to agreements in September 2007, the widened rift between the two organizations were never patched and the coalition remained in name only. Such development was inevitable with the negotiations dragging on.

This work draws attention to the collective action of the workers in a workplace with different types of employment contracts. The conflicts stemming from the status gap between the regular and temporary workers are not restricted to the EGLU-NLU case . How can a successful labor-labor collective action arise when the two groups perceive themselves to be dividing a fixed-sized pie? How can we forge an overarching collective identity? These questions are potential topics for further work.

CHAPTER 3

POVERTY EFFECTS OF THE MINIMUM WAGE: THE ROLE OF HOUSEHOLD EMPLOYMENT COMPOSITION

3.1 Introduction

Minimum wages are commonly evaluated by labor economists in one of two ways. Some analysts pay primary attention to the fact that a higher minimum wage increases the labor market earnings of those employed, while others emphasize that a higher minimum wage would normally be expected to reduce the number employed (Brown, 1999; Ehrenberg and Smith, 2006; Borjas, 2005). However, an analysis of the effects of these labor market consequences on poverty, which is the ultimate focus of much of the policy discourse, requires two further steps. First, the employment composition of the labor market has to be translated into the employment composition of each household. Second, a method of income sharing within the household must be specified.

In a previous paper (Fields and Kanbur, 2007), in a model with only two types of workers - employed and unemployed - we focused primarily on different ways that incomes might be shared within households and how each affected the impact of minimum wages on poverty. In this chapter we assume perfectly equal income sharing within the household, and focus instead on employment composition. We develop the household distribution of income from the labor market outcomes for a model with good jobs, bad jobs and unemployment, and adults and youths searching for jobs. Such a structure allows us, for example, to incorporate the fact that in countries such as the United States, many minimum wage workers live in non-poor households (Burkhauser et al.,

2000). Then the increase of minimum wages will not be an effective tool for alleviating poverty. The impact of a minimum wage on poverty then depends crucially on the employment composition of households at different levels of income. We ask, when exactly does a higher minimum wage raise poverty, when does it lower poverty, and when is poverty unchanged?

The remainder of the chapter is structured as follows. Section 3.2 presents the main features of the model. Section 3.3 derives the effect of a small increase in the minimum wage. Section 3.4 extends the analysis to large changes in the minimum wage. Section 3.5 summarizes and concludes. Appendices C.1 and C.2 presents proofs for propositions.

3.2 The Model

3.2.1 The Labor Market and Household Employment Composition

In this paper, it is assumed that there is a fixed number of households, normalized at 1. Each household consists of two household members: one adult and one youth. Thus, the total labor supply is 2.

The labor market has two types of jobs. High wage jobs, h, pay a wage w_h. The wage of these "good job" is assumed to be invariant to any changes taking place elsewhere in the labor market. Employment in the high wage sector, denoted x_h, is determined according to a standard downward-sloping labor demand curve $x_h = f(\hat{w}_h)$, $f' < 0$. Low wage jobs, l, pay a minimum wage w_l, which

is determined as a matter of public policy. Employment in these "bad jobs" in the low wage sector is also determined according to a standard downward-sloping labor demand curve $x_l = g(\hat{w}_l)$, $g' < 0$. It is assumed that only adults can be employed in the high wage sector. Adults who fail to find employment in the high wage sector, together with youths, form an undifferentiated pool of applicants for low wage jobs.

The low wage w_l is of course less than the high wage w_h, and households in which both members are employed earn more than households in which only one is employed. In addition, we assume that the low wage is greater than half the high wage. Together, these assumptions imply that

$$0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$$

These inequalities will be maintained throughout this paper.

We now discuss the number of persons earning each of these amounts and the per capita household incomes. Employment in the high wage and low wage sectors are respectively x_h and x_l. Given that the high wage sector employs only adults, the number of whom is normalized at 1, the number of adults seeking low wage jobs is $1 - x_h$. In addition, all youth (the number of which is normalized at 1) also seek low wage jobs. Thus, the number of applicants for low wage jobs is $2 - x_h$, and the probability that a low wage applicant gets a job is $\frac{x_l}{2 - x_h}$. An adult can be employed in a high wage job with probability x_h, employed in a low wage job with probability $(1 - x_h)\frac{x_l}{2 - x_h}$, or unemployed with probability $(1 - x_h)(1 - \frac{x_l}{2 - x_h})$. A youth can be employed in a low wage job with probability $\frac{x_l}{2 - x_h}$ or unemployed with probability $1 - \frac{x_l}{2 - x_h}$. Putting these respective wages and employment probabilities together, we have six possible types of households, where A_i, $i = h, l, u$ is the employment state of the adult and Y_j,

$j = l, u$ is the employment state of the youth; see Table 3.1 All household mem-

Table 3.1: Types of Households and Distribution of Earnings.

Type of household	Number of Occurrences	Total Household Earnings	Household Earnings Per Capita
H1. (A_h, Y_l)	$x_h \frac{x_l}{2 - x_h}$	$w_h + \hat{w}_l$	$\frac{w_h + \hat{w}_l}{2}$
H2. (A_l, Y_l)	$(1 - x_h)(\frac{x_l}{2 - x_h})(\frac{x_l}{2 - x_h})$	$2\hat{w}_l$	$\hat{w}_l$
H3. (A_h, Y_u)	$x_h(1 - \frac{x_l}{2 - x_h})$	w_h	$\frac{w_h}{2}$
H4. (A_l, Y_u)	$(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})$	$\hat{w}_l$	$\frac{\hat{w}_l}{2}$
H5. (A_u, Y_l)	$(1 - x_h)(1 - \frac{x_l}{2 - x_h})(\frac{x_l}{2 - x_h})$	$\hat{w}_l$	$\frac{\hat{w}_l}{2}$
H6. (A_u, Y_u)	$(1 - x_h)(1 - \frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})$	0	0

bers are assumed to share their earnings. Hence household earnings per capita is the relevant measure of the well-being of each individual in the household. Clearly the poorest individuals are those who live in households where nobody works (H6). Next come individuals in households where one member is unemployed but the other member is employed in the minimum wage sector (H4 and H5). Given our assumption that the high wage is less than twice the low wage, the case where the adult has a high wage job but the youth is unemployed (H3) gives lower per capita income than the case where both the adult and the youth are employed in the low wage sector (H2). Finally, the highest household per capita income occurs when the adult has a good job and the youth is employed in the minimum wage sector (H1). Table 3.1 sets out, therefore, the income distribution in this society. We turn now to the measurement of poverty based on

this income distribution.

3.2.2 How Poverty Is Measured

Poverty in this paper is measured in absolute terms. The analysis consists of determining how poverty in the labor market varies with changes in $\hat{w}_l$. Poverty is gauged by comparing the households labor market earnings to a fixed poverty line z. The poverty line is $\$z$per person, i.e., $\$2z$ per household.

How high the fixed poverty line is itself allowed to vary. Five cases are analyzed in this paper. Moving from the lowest poverty line to the highest, they are:

$$Case\ 1 : 0 < z < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$$

$$Case\ 2 : 0 < \frac{\hat{w}_l}{2} < z < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$$

$$Case\ 3 : 0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < z < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$$

$$Case\ 4 : 0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < z < \frac{\hat{w}_l + w_h}{2}$$

$$Case\ 5 : 0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2} < z.$$

Case 1 is where the poverty line is so low that only households with all members unemployed are poor. Case 2 brings into the poverty net those households where one member is unemployed but the other member has a minimum wage job. These households will benefit from a rise in the minimum wage if they

hold onto the minimum wage job. Case 3 widens the poverty net still further to include households where the adult is employed in the high wage sector but the youth is unemployed. Case 4 sets the poverty line at a sufficiently high level that income from two minimum wage jobs is not enough to pull the household out of poverty. Finally, Case 5 is the extreme case where the poverty line is so high that everybody is in poverty. Observers who argue that the minimum wage does not target poverty very well are clearly thinking of Cases 1 through through 4, in which non-poor households have minimum wage earners. But in Cases 2 through 5, poor households also have minimum wage workers. Hence in Cases 2, 3 and 4, minimum wage workers are to be found in both poor and non-poor households.

In all cases, poverty is gauged using the class of absolute poverty indices developed by Foster et al. (1984). The FGT index, denoted P_α, takes each poor person's poverty deficit as a percentage of the poverty line, raises it to a power α, and averages over the entire population. Letting y_i be the income of the i-th person, z the poverty line, q the number of poor persons, and n the total number of persons, the P_α poverty measure is given by:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left(\frac{z - y_i}{z} \right)^\alpha .$$

Three specific values of α are of particular interest. As is well known, when $\alpha = 0$ this measure collapses to the headcount ratio, the fraction of people below the poverty line. Other interesting values of α are when α is greater than or equal to one. Benchmark values in this range are$\alpha = 1$, in which case we have the income gap measure of poverty, and $\alpha = 2$, which is known as the squared poverty gap measure. The higher is α, the greater is the sensitivity of poverty to changes in the incomes of the poorest compared to the incomes of the not so poor. For these reasons, α is known as the poverty aversion parameter. To allow

for the social loss from poverty to increase at an increasing rate as incomes fall relative to the poverty line, α must be greater than 1. Because of the intuitive appeal of integer values of α, it is common for empirical poverty researchers to choose $\alpha = 2$. Different degrees of poverty aversion will be seen to be important in delineating the consequences of the minimum wage for poverty.

We turn now to the poverty effects of higher minimum wages in this model.

3.3 The Poverty Effects of a Higher Minimum Wage Within Each of the Five Cases

We have set forth five cases above. For each of these five cases, different types of tradeoffs are involved in raising the minimum wage. The results are summarized in Table 2

The detailed derivations are given in the Appendix C.1. Here we will provide an intuitive discussion of the results. The results fall into three groups and will be discussed accordingly: 1) The results for $\alpha = 0$, in which $\frac{dP_\alpha}{d\hat{w}_l} > 0$. 2) The results for Case 1, also in which $\frac{dP_\alpha}{d\hat{w}_l} > 0$ 3) The results for $\alpha \geq 1$ in Cases 2 through 5, in which $\frac{dP_\alpha}{d\hat{w}_l} > (<) 0$ if the elasticity of labor demand in the minimum wage sector η is sufficiently high (low).

The first set of results (for $\alpha = 0$) can be understood in a similar way for all five cases. When $\alpha = 0$, the poverty measure being used is the poverty headcount ratio. A higher minimum wage causes more people to become unemployed, which raises the number of households in poverty, i.e., $\frac{dP_\alpha}{d\hat{w}_l} > 0$. Given

Table 3.2: Summary of Results Concerning the Effect of a Minimum Wage Increase on Poverty as Gauged by P_α.

	Case 1	Case 2	Case 3	Case 4	Case 5
$\alpha = 0$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	$\frac{dP_\alpha}{d\hat{w}_l} = 0$
$\alpha = 1$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When $\eta \geq (\leq)1$, $\frac{dP_\alpha}{d\hat{w}_l} \geq (<)0$
$\alpha > 1$	$\frac{dP_\alpha}{d\hat{w}_l} > 0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$	When η is sufficiently high (low) $\frac{dP_\alpha}{d\hat{w}_l} > (<)0$

that the P_0 poverty measure focuses only on the numbers in poverty and not on how poor the poor are, the gains to the incomes of poor working households is not counted, and poverty (measured by the number in poverty) always rises. The only reason that $\frac{dP_\alpha}{d\hat{w}_l} = 0$ (in Case 5) is that the poverty line is so high that everybody is in poverty to begin with, and so no further increase in poverty is possible.

The second set of results is for Case 1, i.e., the case in which the only poor households are those for which both household members are unemployed. Thus an increase in the minimum wage cannot possibly affect their incomes, but their numbers will increase with the rise in unemployment. Thus, no matter what the value of α, in this case, an increase in the minimum wage will increase

poverty, i.e., $\frac{dP_\alpha}{d\hat{w}_l} > 0$.

The third set of results is for $\alpha \geq 1$ in Cases 2 through 5. In each of these cells, $\frac{dP_\alpha}{d\hat{w}_l} > 0$ when η is sufficiently high and $\frac{dP_\alpha}{d\hat{w}_l} < 0$ when η is sufficiently low. That is, when the elasticity of labor demand is greater than the critical value corresponding to that particular case, as the minimum wage increases, poverty will increase. Poverty will rise when the unemployment effect of a minimum wage increase dominates the earnings effect. Of course, this is more likely the greater the elasticity of demand for labor. On the other hand, when the elasticity of labor demand is less than the critical value, as the minimum wage increases, poverty will decrease: the earnings effect dominates the unemployment effect.

This completes our analysis of how poverty changes locally with the minimum wage within each of the five cases. Let us now analyze what happens when changes in the minimum wage are so large that we move across cases.

3.4 The Poverty Effects of a Large Increase in the Minimum Wage

Section 3.1 analyzed the effects of an infinitesimal increase in the minimum wage. In this section, we ask what happens if the minimum is increased discretely. On the one hand, the discrete jump in the minimum wage can occur within a case. When this happens, the effect of the minimum wage on poverty is the integral of all the infinitesimal changes. No new analysis is needed when this happens. On the other hand, the discrete jump in the minimum wage can cause the economy to switch from one case to another. We show in this section

that when such a switch occurs, the change in poverty may be discontinuous and, moreover, may go in the opposite direction from what happens on either side of the discontinuity.

3.4.1 Two Examples

It is possible to gain further insights by looking at specific numerical examples. These examples will then be used to derive more general results.

The two examples we present are similar in most respects. They have the same high wage $\hat{w}_h = 15$, the same employment at the high wage $x_h = 0.1$, the same range of possible minimum wages (from $\frac{\hat{w}_h}{2} = 7.5$ to $\hat{w}_h = 15$), the same constant elasticity of demand for labor in the low wage sector $\eta = 0.7$, and the same demand for labor curve in the low wage sector $x_l = 0.3 - 0.7ln\hat{w}_l$. The two examples differ in one important respect, however: in Example 1, the poverty line z is in the range $z < \frac{w_h}{2}$, while in Example 2, the poverty line z is in the range $z > \frac{w_h}{2}$. (Note: In Cases 1 and 2,$z < \frac{w_h}{2}$, while in Cases 3 through 5, $z > \frac{w_h}{2}$) For the calculations below, $z = 5$ in Example 1 and $z = 12.5$ in Example 2.

To analyze how poverty as measured by P_α changes with $\frac{\hat{w}_l}{z}$ our strategy is to fix z and raise $hatw_l$ from the lowest possible value to the highest possible value. We do this first when $z < \frac{w_h}{2}$ and then when $z > \frac{w_h}{2}$.

3.4.2 Analysis for the Poverty Headcount Ratio ($\alpha = 0$)

We start with the situation where α is chosen to equal 0, i.e., the poverty measure is the headcount ratio. The headcount ratio is sensitive only to the number of people below the poverty line but not to the severity of their poverty. This means that changing the minimum wage induces only an unemployment effect but no earnings effect.

When $P_\alpha = 0$, the unemployment effect operates in the same way in Cases 1 through 4: an increase in the minimum wage reduces employment in the low wage sector, thereby increasing poverty as long as we remain within any of these four cases. In Case 5, however, everyone is poor and remains so, and therefore a change in the minimum wage has no effect on the poverty headcount.

What happens within a case is not the same as what happens in moving from one case to the next. To illustrate this point, consider Figures 3.1 and 3.2 .

Figure 1 graphs the poverty headcount ratio P_0 in Example 1. We see that P_0 increases as the minimum wage rises within Case 2. However, there is a discontinuous fall in P_0 at $\hat{w}_l = 10$. Why 10? Because that is twice the poverty line (5 in Example 1), which is the boundary between Case 2 and Case 1. When the minimum wage rises above 10, all of the people living in households with just one member employed at the minimum wage suddenly escape from poverty. We are now in the range of Case 1. In that range, a further increase of the minimum wage decreases employment and therefore raises the poverty headcount. This range ends just before the minimum wage equals the high wage, i.e., as $\hat{w}_l \to \hat{w}_h$?

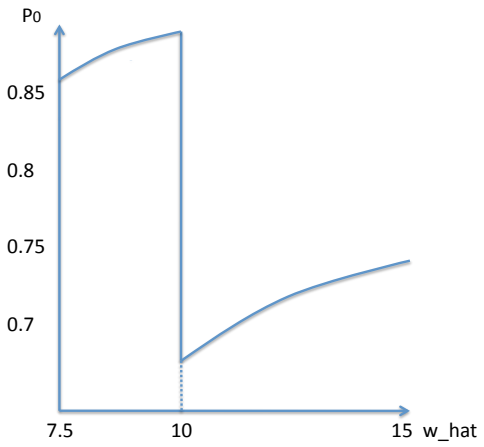

Figure 3.1: P_0 as a function of $\hat{w}_l$ in Example 1.

Suppose we continue to maintain that $0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$ but now $z > \frac{w_h}{2}$. These conditions hold in Example 2. Figure 3.2 graphs the poverty head-count ratio P_0 in Example 2. The figure shows that as the minimum wage rises, P_0 is constant (at 1) in Case 5 and increases within Cases 4 and 3. It also shows discontinuous drops at the boundaries of the Cases. The reason is analogous to Example 1. At the boundary between Cases 5 and 4, all of the households with the maximum possible earnings that is, those in which the adult is employed in a high wage job and the youth in a low wage job suddenly escape poverty. Similarly, at the boundary between Cases 4 and 3, those households in which both the adult and the youth are employed in low wage jobs suddenly escape poverty.

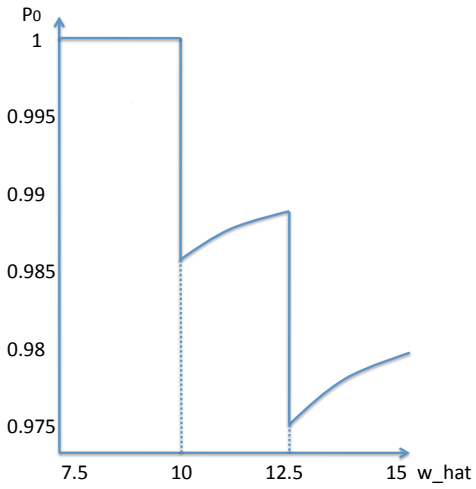

Figure 3.2: P_0 as a function of $\hat{w}_l$ in Example 2.

These examples illustrate results that are quite general:

Proposition 3.1 *When* $0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$ *and* $z > \frac{w_h}{2}$, *an increase in the minimum wage raises* P_0 *within a case but may lower* P_0 *if the economy crosses from Case 2 to Case 1.*

Proof: In Appendix C.2

Turning now to the case exemplified by Figure 3.2, we have the following general result:

Proposition 3.2 *When* $0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$, *an increase in the minimum wage leaves* P_0 *unchanged if the minimum wage remains within Case 5, raises* P_0 *if*

the minimum wage remains within Case 4 or Case 3, and may lower P_0if the economy crosses from Case 5 to Case 4 or from Case 4 to Case 3.

Proof: In Appendix C.2.

This completes our analysis of how the poverty headcount ratio P_0 varies with the minimum wage $\hat{w}_l$. We turn now to the analysis of the situation where poverty is measured by the squared poverty gap P_2.

3.4.3 Analysis for the Squared Poverty Gap ($\alpha = 2$)

The squared poverty gap P_2 is sensitive both to the number of people below the poverty line and to the severity of their poverty. Changing the minimum wage will induce both an unemployment effect and an earnings effect. As detailed in Section 3.3, poverty as measured by P_2 may increase or decrease depending on the relative size of these two effects.

Figure 3.3 graphs the squared poverty gap P_2 in Example 1. In this particular example, as the minimum wage increases, P_2 increases in both Cases 2 and 1. This is not a general result: P_2 could be increasing, decreasing, or change sign within either of the two Cases. Figure 3.4 graphs the squared poverty gap P_2 in Example 2. In this particular example, we have a U-shaped pattern: as the minimum wage increases, P_2 decreases in Case 5, decreases and then increases in Case 4, and increases throughout Case 3. This U shape is not a general result: P_2 could be decreasing throughout, increasing throughout, or change sign depending on parameter values. The general result is:

Proposition 3.3 *When* $0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{\hat{w}_l + w_h}{2}$, *$P_2$ is a continuous function of*

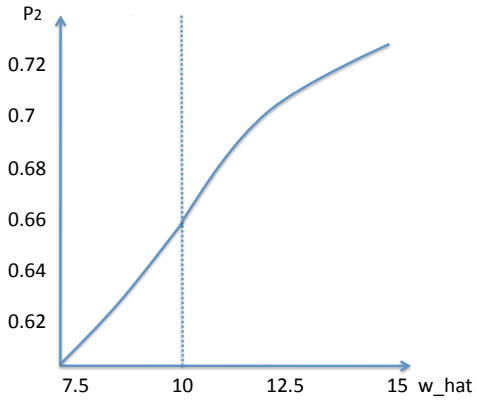

Figure 3.3: P_2 as a function of $\hat{w}_l$ in Example 1.

the minimum wage $\hat{w}_l$.

Proof: In Appendix C.2.

Although the behavior of P_2 with respect to the minimum wage is continuous, it can be non-monotonic, as shown in Figure 3.4 . This once again means that local findings, whether theoretical or empirical, are not necessarily a good guide to the implications of discrete changes. Thus, in Figure 3.4, while a small increase in the minimum wage for low values of the wage may lower poverty, a sufficiently large increase may have the opposite effect. On the other hand, just because an increase in the minimum wage from a particular starting point is observed to increase poverty is no guarantee that an increase in the minimum wage will have the same effect as an increase in the minimum wage from some

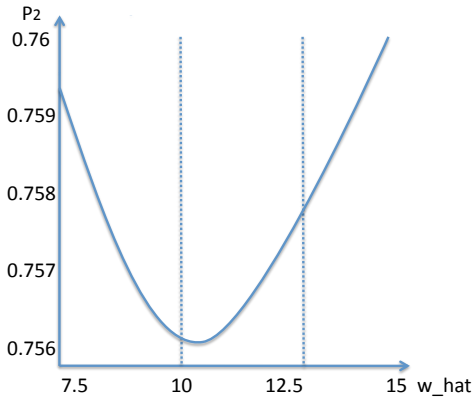

Figure 3.4: P_2 as a function of $\hat{w}_l$ in Example 2.

other starting point.

3.5 Conclusion

Fields and Kanbur (2007) brought the issue of income-sharing within the household to the forefront of the debate on the poverty impact of minimum wages. That paper showed how this poverty impact depends crucially on the income-sharing rule.

In this paper, the following model has been used. We have assumed equal sharing within the household to highlight the importance of the household employment composition. Each household consists of one adult and one youth.

There are two types of jobs, high wage jobs and low wage jobs. The minimum wage applies to low wage jobs. Only adults may be hired for the high wage jobs. Those adults not hired for the high wage jobs and all youth compete for the low wage jobs. Of these, the ones not hired in the low wage jobs are unemployed. This structure determines the employment composition of each household, which in turn determines its income. A household is poor if and only if its per capita earnings are below a pre-established poverty line.

We showed that a minimum wage increase can raise poverty, lower poverty, or leave poverty unchanged. The particular outcome depends on the specific balance between the high wage, the low wage, employment in high-wage and low-wage jobs, the elasticity of demand for labor with respect to the minimum wage, and the value of α chosen.

Table 2 summarizes the patterns that arise depending on how high the poverty line is and which value of α is chosen. The fifteen cells of Table 2 reflect what happens within a case. In addition, minimum wage changes may be large enough to cause movements across cases. We proved three propositions relating to movements across cases, showing that P_0 necessarily changes discontinuously when crossing cases and that P_2 necessarily changes continuously when crossing cases. Furthermore, we demonstrated that there may be non-monotonicities in the relationship, which means that local results - theoretical or empirical - are not necessarily a good guide to the effects of discrete changes.

The results derived here reinforce the general conclusion from Fields and Kanbur (2007) that no simple statement can be made about whether an increase in the minimum wage raises poverty, lowers poverty, or leaves poverty unchanged. A detailed analysis is needed before conclusions can be drawn. This

strongly suggests that the nature of the policy debate should shift from the simplistic "yes" versus "no" format that is current to a more nuanced discussion of the precise conditions under which a minimum wage will or will not reduce poverty.

APPENDIX A

APPENDIX TO CHAPTER 1

A.1 Proofs of Propositions

Proposition 1.1 We show that $L_l^* \geq L_h^*$ for all $a \geq 1$ and $0 \leq k \leq \underline{L}$.

$$\begin{aligned} L_l^* - L_h^* &= \frac{A+k}{4} - \frac{Aa}{2a^2+2} \\ &= (\frac{A}{4} - \frac{Aa}{2a^2+2}) + \frac{k}{4} \\ &= \frac{A(a-1)^2}{4(a^2+1)} + \frac{k}{4}. \end{aligned}$$

The first term in the RHS is always non-negative, which makes the overall expression always non-negative.

Proposition 1.2 Let's find the range of k that gives us $\pi_l^* \leq \pi_h^*$.

$$\pi_h^* - \pi_l^* = \frac{a^2A^2}{4(a^2+1)} - \frac{(A+k)^2}{8} \geq 0.$$

Rearranging this and solving for k, one gets $A(\sqrt{\frac{2a^2}{a^2+1}} - 1) \geq k$. That is, if k is less than $\bar{k}(a) = A(\sqrt{\frac{2a^2}{a^2+1}} - 1)$, then $\pi_l^* \leq \pi_h^*$. Taking a derivative of $\bar{k}(a)$ with respect to a, we get $\frac{d\bar{k}}{da} = \frac{\sqrt{2}A}{(a^2+1)^{3/2}}$, which is always greater than zero.

Proposition 1.3 Profit maximizing monopolist wage level is w_l^* so when $\hat{w}$ is set at w_l^* the firm will be yielding the maximum profit possible. Let's now prove that the profit function has a smooth concave shape with respect to $\hat{w}$. Note here that we have to divide the range of $\hat{w}$ into two: $\hat{w} \leq \underline{w}$ and $\hat{w} > \underline{w}$, where

$\underline{w} = \frac{A-2k}{3}$, since the expression for firm's profit is different for each. Let's suppose $\hat{w} \leq \underline{w}$: differentiating $\pi_{c1} = (A - 2\hat{w} - k)(\hat{w} + k)$ with respect to $\hat{w}$, $\frac{d\pi_{c1}}{d\hat{w}} = -4\hat{w} - 3k + A$, which is positive when $\hat{w} \leq \frac{A-3k}{4}$ and negative when $\hat{w} \geq \frac{A-3k}{4}$. Differentiating it again with respect to $\hat{w}$, we get -4, showing that it is indeed a concave function with a maximum at $\hat{w} = w_l^*$. When $\hat{w}$ hits $\underline{w} = \frac{A-2k}{3}$, we now have π_{c2} to consider. Differentiating $\pi_{c2} = \frac{(A-\hat{w})^2}{4}$, $\frac{d\pi_{c2}}{d\hat{w}} = -\frac{A-\hat{w}}{2}$. This is always negative since we know that $A - \hat{w} \geq 0$.

The next step is to show that $\pi_{c1}(\underline{w}) \geq \pi_{c2}(\underline{w})$.

$$\begin{aligned}
\pi_{c1}(\underline{w}) =& (A - 2\underline{w} - k))(\underline{w} + k) \\
=& (A - 2(\frac{A-2k}{3}) - k)(\frac{A-2k}{3} + k) \\
=& (\frac{A+k}{3})^2. \\
\pi_{c2}(\underline{w}) =& \frac{(A-\underline{w})^2}{4} \\
=& \frac{(A - \frac{A-2k}{3})^2}{4} \\
=& (\frac{A+k}{3})^2.
\end{aligned}$$

Therefore $\pi_{c1}(\underline{w}) = \pi_{c2}(\underline{w})$. We have proved that π_c is a decreasing continuous function for $\hat{w} \in [w_l^*, A]$.

Proposition 1.5 In order to have $\pi_i \geq \pi_h^*$,

$$\pi_i - \pi_h^* = \frac{(A - \delta + k)^2}{8} - \frac{a^2 A^2}{4(a^2+1)} \geq 0$$

Rearranging and solving for δ, we get

$$k - A(\sqrt{\frac{2a^2}{a^2+1}} - 1) \geq \delta.$$

Note here that the second term in the LHS is $\bar{k}(a)$ in proposition 3. That is, in order to have $\pi_i \geq \pi_h^*$, δ has to be such that $k - \bar{k}(a) \geq \delta$. We denote $k - \bar{k}(a)$ with $\tilde{\delta}$. Now let's see how this cut-off value of δ changes with respect to a and k.

$$\frac{d(k - \bar{k}(a))}{dk} > 0.$$
$$\frac{d(k - \bar{k}(a))}{da} = -\frac{d\bar{k}(a)}{da} \leq 0.$$

Proposition 1.6 This proposition builds up on proposition 1.3. Let's define the function $G(\hat{w})$ as $G(\hat{w}) = \pi_c(\hat{w}) - \pi_i$. We know that $\frac{dG(\hat{w})}{d\hat{w}} < 0$ for $\hat{w} \in [w_l^*, w_h^*]$. There are two cases to consider. The first case is when $G(w_h^*) \leq 0$ and the second case is when $G(w_h^*) \geq 0$. Suppose $G(w_h^*) < 0$. Then since $G(w_l^*) = \frac{(A+k)^2}{8} - \frac{(A-\delta+k)^2}{8} > 0$ and $G(w_h^*) < 0$, we know from the Intermediate Value Theorem that there exists at least one solution w^* for $G(\hat{w}) = 0$. For a strictly decreasing function $G(\hat{w})$, the solution is unique. Suppose there are two solutions w_1^* and w_2^* (where $w_1^* < w_2^*$) for $G(\hat{w}) = 0$ such that $G(w_1^*) = 0$ and $G(w_2^*) = 0$. Since $G(\hat{w})$ is a strictly decreasing function, it has to be that $G(w_1^*) > G(w_2^*)$. This is a contradiction. So there is a unique solution w^*. (Another proof can be done using the Banach fixed point theorem.)

Suppose now that $G(w_h^*) \geq 0$. Then using the Intermediate Value Theorem, we can see that for the range $[w_l^*, A]$, there exists a unique solution that gives us $G(\hat{w}) = 0$ and that the solution w^* will be satisfying $w^* > w_h^*$. This means that if $G(w_h^*) \geq 0$, then there will be no w^* that lies between $[w_l^*, w_h^*]$.

Therefore, we need the condition $G(w_h^*) \leq 0$ for the existence of the solution

in the range $[w_l^*, w_h^*]$. That is

$$\begin{aligned} G(w_h^*) &= \pi_c(w_h^*) - \pi_i \leq 0 \\ &= \frac{(A - w_h^*)^2}{4} - \frac{(A - \delta + k)^2}{8} \leq 0 \end{aligned}$$

Rearranging the terms with respect to δ, $\delta \leq (1 - \sqrt{2}(1 - \frac{a}{2(a^2+1)}))A + k$ or $\delta \leq \bar{\delta}$, if we write $(1 - \sqrt{2}(1 - \frac{a}{2(a^2+1)}))A + k$ as $\bar{\delta}$. Combining $\tilde{\delta} \geq \delta$ with this expression, we get $\delta \leq min[\bar{\delta}, \tilde{\delta}]$.

Proposition 1.7 When $\pi_i \geq \pi_c(\underline{w})$, similarly as in proposition 1.6 we have shown a general uniqueness of the solution w^*, there will exist a unique $\bar{w}$ such that for $\hat{w}$ satisfying $\bar{w} \leq \hat{w}$, the firm will Comply. For $\bar{w} \geq \hat{w}$ the firm will Ignore.

The parameters, A, k, a, and δ, however, have to satisfy several conditions. First, from solving for $\pi_i \geq \pi_h$ with respect to δ, we have shown in proposition 1.6 that δ has to satisfy $\tilde{\delta} \geq \delta$. Let's now solve for $\pi_i \geq \pi_c(\underline{w})$.

$$\begin{aligned} \pi_c(\underline{w}) - \pi_i &= \frac{(A + k)^2}{9} - \frac{(A - \delta + k)^2}{8} \leq 0 \\ \delta &\leq (1 - \frac{2\sqrt{2}}{3})(A + k). \end{aligned}$$

In order to have a unique solution $\bar{w}$, $\delta \leq min[\tilde{\delta}, (1 - \frac{2\sqrt{2}}{3})(A + k)]$. Now let's calculate what $\bar{w}$ is. To have $\pi_{c1} = \pi_i$,

$$\pi_{c1} - \pi_i = (A - 2\hat{w} - k)(\hat{w} + k) - \frac{(A - \delta + k)^2}{8} = 0.$$

To simplify the problem, let's suppose $D = A + k$ and $E = \hat{w} + k$. Now the problem becomes

$$(D - 2E)E - \frac{(D - \delta)^2}{8} = 0.$$

Solving this with respect to E and plugging in the original expressions for E and D, we get

$$E - \frac{D}{4} = -\frac{\sqrt{\delta(2A + 2k - \delta)}}{4}$$
$$\hat{w} = \frac{A - 3k}{4} - \frac{\sqrt{\delta(2A + 2k - \delta)}}{4},$$

or

$$E - \frac{D}{4} = \frac{\sqrt{\delta(2A + 2k - \delta)}}{4}$$
$$\hat{w} = \frac{A - 3k}{4} + \frac{\sqrt{\delta(2A + 2k - \delta)}}{4}.$$

Note here that the first solution cannot hold since $\frac{A - 3k}{4} - \frac{\sqrt{\delta(2A + 2k - \delta)}}{4} \leq \frac{A + k}{4} = w_l^* < \hat{w}$ by assumption. Therefore the solution $\bar{w}$ to $\pi_{c1} = \pi_i$ becomes $\frac{A - 3k}{4} + \frac{\sqrt{\delta(2A + 2k - \delta)}}{4}$.

Proposition 1.8 Differentiating $\bar{w}$ with respect to k, we have $\frac{d\bar{w}}{dk} = \frac{-3}{4} + \delta/4\sqrt{\delta(2A + 2k - \delta)}^{-1}$. By assumption of proposition 1.7, $\tilde{\delta} \geq \delta$, i.e., $k - \bar{k} \geq \delta$, and since $\bar{k} > 0$, we have $2A + 2(k - \delta) > 0$ and therefore $2A + 2k - \delta > \delta$. Then we can conclude that the above equation has to satisfy

$$\frac{d\bar{w}}{dk} = \frac{-3}{4} + \frac{\delta}{4}\sqrt{\delta(2A + 2k - \delta)} \leq \frac{-3}{4} + \frac{\delta^2}{4}.$$

Since $\frac{-3}{4} + \frac{\delta^2}{4} < 0$ for all $\delta \in [0, 1]$, we know that $\frac{d\bar{w}}{dk} < 0$. Now, differentiating $\bar{w}$ with respect to δ we have

$$\frac{d\bar{w}}{d\delta} = 1/8\sqrt{\delta(2A + 2k - \delta)}^{-1}(2A + 2k - 2\delta).$$

This expression is always positive because as we have shown above, $2A + 2k - 2\delta > 0$.

Proposition 1.9 When $0 < \pi_i \leq \pi_c(\underline{w})$, since $\pi_c(\underline{w})$ is a decreasing function, $G(\underline{w}) > 0$. We also know that $G(A) = 0$. Similarly as in the proof of proposition1.6, we can show that there will exist a unique $\tilde{w} > \underline{w}$ such that for $\hat{w}$ satisfying $\tilde{w} \leq \hat{w}$ the firm will Comply. For $\tilde{w} \geq \hat{w}$, the firm will Ignore. In order to have that $\tilde{w}$ lie in $[w_l^*, w_h^*]$, as we have done it in proposition 1.6, we have to restrict the δ so that $G(w_h^*) \leq 0$. So we have the pre-condition for proposition 1.9, $\delta \leq min[\bar{\delta}, \tilde{\delta}]$. Given this, we know there exists a cut-off. Let's now calculate what it is.

Solving for $\pi_i \leq \pi_c(\underline{w})$,

$$\pi_c(\underline{w}) - \pi_i = \frac{(A+k)^2}{9} - \frac{(A-\delta+k)^2}{8} \geq 0$$
$$\delta \geq (1 - \frac{2\sqrt{2}}{3})(A+k).$$

In order to have a unique solution $\tilde{w}$, $\delta \leq min[\bar{\delta}, \tilde{\delta}]$ and $\delta \geq (1 - \frac{2\sqrt{2}}{3})(A+k)$. Let's now get the value of $\tilde{\delta}$.

In order to have $\pi_{c2} = \pi_i$,

$$\pi_{c2} - \pi_i = \frac{(A-\hat{w})^2}{4} - \frac{(A-\delta+k)^2}{8} = 0.$$

Rearranging and solving for $\hat{w}$, we get:

$$\frac{(\sqrt{2}-1)A + \delta - k}{\sqrt{2}} = \hat{w}.$$

Therefore, the solution to $\pi_{c2} = \pi_i$ is $\tilde{w} = \frac{(\sqrt{2}-1)A + \delta - k}{\sqrt{2}}$.

Proposition 1.10 Differentiating $\frac{(\sqrt{2}-1)A+\delta-k}{\sqrt{2}} = \tilde{w}$ with respect to k, $\frac{d\tilde{w}}{dk} = -\frac{1}{\sqrt{2}} < 0$. Differentiating $\tilde{w}$ with respect to δ we have $\frac{d\tilde{w}}{d\delta} = \frac{1}{\sqrt{2}} > 0$. Differentiating $\frac{(\sqrt{2}-1)A+\delta-k}{\sqrt{2}} = \tilde{w}$ with respect to k, $\frac{d\tilde{w}}{dk} = -\frac{1}{\sqrt{2}} < 0$. Differentiating $\tilde{w}$ with respect to δ we have $\frac{d\tilde{w}}{d\delta} = \frac{1}{\sqrt{2}} > 0$.

Proposition 1.11 The complete proof is omitted because it is similar to the proof of proposition 1.6. There is one condition that a has to satisfy $-4a^3 + 5a^2 - 4a + 4 \leq 0$. This condition corresponds to $\delta \leq \bar{\delta}$ in proposition 1.6. We want $\pi_c(w_h^*) - \pi_h(w_h^*) \leq 0$ to guarantee the existence of a cut-off w^* that lies between $w^* \in [w_l^*, w_h^*]$.

Let's start from $\pi_c(w_h^*) - \pi_h(w_h^*) \leq 0$. For this to be true,

$$\pi_c(w_h^*) - \pi_h(w_h^*) = \frac{(A - \frac{Aa}{2(a^2+1)})^2}{4} - \frac{A^2a^2}{4(a^2+1)} \leq 0$$

Rearranging the terms with respect to a we get $-4a^3+5a^2-4a+4 \leq 0$. That is, for there to be a unique cutoff, a has to satisfy the condition $-4a^3 + 5a^2 - 4a + 4 \leq 0$.. If $-4a^3 + 5a^2 - 4a + 4 \geq 0$, then for all $\hat{w}* \in [w_l^*, w_h^*]$, the firm will Comply.

Proposition 1.12 When $\pi_h \geq \pi_c(\underline{w})$, similarly as in the proposition we have shown a general uniqueness of the solution w^*, there will exist a unique $\check{w}$ such that for $\hat{w}$ satisfying $\check{w} \leq \hat{w}$ the firm will Comply. For $\check{w} \geq \hat{w}$ the firm will Move. The parameters, A, k, a, and δ, however, have to satisfy several conditions. First, from solving for $\pi_i \leq \pi_h$ with respect to δ, we have shown in proposition 1.6 that

δ has to satisfy $\tilde{\delta} \leq \delta$. Let's now solve for $\pi_h \geq \pi_c(\underline{w})$.

$$\pi_c(\underline{w}) - \pi_h = \frac{(A+k)^2}{9} - \frac{(Aa)^2}{4(a^2+1)} \leq 0$$
$$k \leq A(\frac{3a}{2\sqrt{a^2+1}} - 1).$$

So in order to have a unique solution $\check{w}$, $\tilde{\delta} \leq \delta$ and $k \leq A(\frac{3a}{2\sqrt{a^2+1}} - 1)$.

Now let's calculate what $\check{w}$ is. To have $\pi_{c1} = \pi_h$,

$$\pi_{c1} - \pi_h = (A - 2\hat{w} - k)(\hat{w} + k) - \frac{a^2A^2}{4(a^2+1)} = 0.$$

To simplify the problem, let's suppose $D = A+k$ and $E = \hat{w}+k$. Now the problem becomes

$$(D - 2E)E - \frac{a^2A^2}{4(a^2+1)} = 0.$$

Solving this with respect to E and plugging in the original expressions for E and D, we get:

$$E - \frac{D}{4} = -\sqrt{\frac{D^2}{16} - \frac{a^2A^2}{8(a^2+1)}}$$
$$\hat{w} = \frac{A-3k}{4} - \sqrt{\frac{(A+k)^2}{16} - \frac{a^2A^2}{8(a^2+1)}}$$

or

$$E - \frac{D}{4} = \sqrt{\frac{D^2}{16} - \frac{a^2A^2}{8(a^2+1)}}$$
$$\hat{w} = \frac{A-3k}{4} + \sqrt{\frac{(A+k)^2}{16} - \frac{a^2A^2}{8(a^2+1)}}.$$

Note here that the first solution cannot hold since $\frac{A-3k}{4} - \sqrt{\frac{(A+k)^2}{16} - \frac{a^2A^2}{8(a^2+1)}} \leq \frac{A+k}{4} = w_l^* < \hat{w}$ by assumption. The solution $\check{w}$ to $\pi_{c1} = \pi_h$ can be calculated as

$$\frac{A-3k}{4}+\sqrt{\frac{(A+k)^2}{16}-\frac{a^2A^2}{8(a^2+1)}}.$$

Proposition 1.13 Differentiating $\check{w} = \frac{A-3k}{4}+\sqrt{\frac{(A+k)^2}{16}-\frac{a^2A^2}{8(a^2+1)}}$ with respect to k:

$$\begin{aligned}\frac{d\check{w}}{dk} &= -\frac{3}{4}+\frac{1}{16}(A+k)\left(\sqrt{\frac{(A+k)^2}{16}-\frac{a^2A^2}{8(a^2+1)}}\right)^{-1}\\ &= -\frac{3}{4}+\frac{1}{16}\left(\sqrt{\frac{1}{16}-\frac{a^2A^2}{8(a^2+1)(A+k)^2}}\right)^{-1}\\ &\geq -\frac{3}{4}+\frac{1}{16}12=0.\end{aligned}$$

The last line comes from using $\frac{(A+k)^2}{9}-\frac{(Aa)^2}{4(a^2+1)}\leq 0$ (the fact that $\pi_h \geq \pi_c(\underline{w})$). So $\frac{d\check{w}}{dk}>0$. Now, differentiating $\check{w}$ with respect to a we have

$$\frac{d\check{w}}{da}=\frac{-aA^2}{8\sqrt{\frac{(A+k)^2}{16}-\frac{a^2A^2}{8(a^2+1)}}}<0.$$

Proposition 1.14 When $\pi_h \leq \pi_c(\underline{w})$, similarly as in the other propositions where we have shown a general uniqueness of the cut-off w^*, there will exist a unique $\dot{w}$ such that for $\hat{w}$ satisfying $\dot{w}\leq\hat{w}$ the firm will Comply. For $\dot{w}\geq\hat{w}$ the firm will Move.

The parameters, A, k, a, and δ, however, have to satisfy several conditions. First, from solving for $\pi_i \leq \pi_h$ with respect to δ, we have shown in proposition 1.6 that δ has to satisfy $\tilde{\delta}\leq\delta$. Let's now solve for $\pi_h \leq \pi_c(\underline{w})$.

$$\begin{aligned}\pi_c(\underline{w})-\pi_h &= \frac{(A+k)^2}{9}-\frac{(Aa)^2}{4(a^2+1)}\geq 0\\ k &\geq A\left(\frac{3a}{2\sqrt{a^2+1}}-1\right).\end{aligned}$$

So in order to have a unique solution $\check{w}$, $\tilde{\delta} \leq \delta$ and $k \geq A(\frac{3a}{2\sqrt{a^2+1}} - 1)$. In order to have $\pi_{c2} = \pi_h$,

$$\pi_{c2} - \pi_h = \frac{(A - \hat{w})^2}{4} - \frac{a^2 A^2}{4(a^2+1)} = 0.$$

Rearranging and solving for $\hat{w}$, we get $\hat{w} = A - \frac{Aa}{\sqrt{a^2+1}}$. Therefore, the solution to $\pi_{c2} = \pi_h$, $\dot{w} = A - \frac{Aa}{\sqrt{a^2+1}}$.

Proposition 1.15 Differentiating $\dot{w}$ with respect to a we have $\frac{d\dot{w}}{da} = -A(a^2 + 1)^{-5/2} < 0$.

APPENDIX B

APPENDIX TO CHAPTER 2

B.1 Game Theoretic Exposition

In the next two subsections, I provide a two stage game theoretical model of coalition formation of interest groups. A movement organization demonstrates for a claim. Given the salience of the claim and the effort level of the organization, the decision maker determines the extent to which it will respond to the demands.

B.1.1 Outline of the Model

Let's first start with two risk neutral social movement organizations (SMOs). The general structure of the framework is as follows. Each organization - 1 and 2 - has a specific "claim" or a discrete $\{0, 1\}$ public good it would like to obtain from the decision maker.[1] Slightly abusing notation, we denote the goods as 1 and 2. This good is public in the sense that its provision affects everyone equally within an organization. In sum, organization j, where $j = 1, 2$, demonstrates for public good j.

The extent to which the claims of SMO 1 and 2 overlap is $b \in (-1, 1)$, a measure of how much an organization discounts the public good promoted by the other. When public good 1 (2) is provided, participants in organization 1 (2) receive a payoff of 1 when those in 2 (1) receive b. When b is close to 1, you

[1] Legislations such as the Civil Rights Act of 1964 could be one example of such public good.

get satisfaction from other organization's public good as if it were yours. The relationship between a movement organization and a countermovement organization can be described with b being close to -1. When $b = 0$, provision of public good 2 (1) does not affect organization 1 (2). I assume that both have the same perception of how much their claims overlap; b is the same across organizations.[2] There are several benefits of having an overlap parameter rather than specifying policy positions as in the public choice literature. First of all, claims of movement organization is multidimensional. Second, they are concerned with the differences rather than the actual positions of the claims when making a decision to cooperate.

An organization or an organizational claim faces a political opportunity - $a_j \in [0, 1]$ - at a specific time period. One can think of the political opportunity as the salience of the claim or the receptiveness of the decision maker. Given the political opportunity, organization j decides on the effort level $0 \leq e_j \leq \bar{e}_j$ to put in to the movement, where $\bar{e}_j$ is the maximum effort level possible.[3] A convex cost function of j, $c_j(e_j)$, reflects the internal resources available to the organization. The functional form of the cost function may differ across organizations.

In sum, a movement organization j can be characterized by a political opportunity a_j and its cost function $c_j(e_j)$. The relationship between the the two - the overlap of their claims - is b. I assume that there exists a single representative participant so that I do not have to worry about the free-rider problem.[4] I also

[2]This does not have to be necessarily true - there could be situations where each organization has different assessments on how much their interests overlap.

[3]Limiting the effort level at $\bar{e}_j$ is convenient as much as it is realistic. This can guarantee existence of a solution when we actually solve the model.

[4]Even though we have a single representative player for every organization, the model can not be considered as one that studies individual level cooperation. A single individual will not be faced with a 'political opportunity'.

assume that the SMO membership is fixed and an individual cannot participate in more than one organization.

When there is no movement (or movement organization) protesting, no public good is provided. When there is a single movement by one SMO, the decision maker provides the good with probability 1. When a coalition of two organizations is formed and they protest together as a group, the decision maker is ambivalent between the two goods.

When there are two separate protests, probability of provision is based on the relative salience of the claims and the effort levels: the probability that good j will be provided can be written as $P_j(e_1, e_2; a_1, a_2)$. I assume that P_j is a concave function of e_j and a_j : if organization j increase its effort, the probability that j will be provided increases at a decreasing rate. When political opportunity opens up for j, again, the probability that j will be provided increases at a decreasing rate.

1 and 2 play a two stage exclusive membership game where coalitions are formed by all the players who have announced the same coalition. When a member leaves the coalition, it assumes that all other members stay where they are.[5] I describe this game in a partition function form (Carraro, 2003, p. 47).

Let's first go over the notations. A coalition $\pi \in \Pi$ is a partition of the set $N = \{1..N\}$ of players, where $\pi = \{C_1, C_2, ..C_i.., C_M\}$ is a set of all coalitions formed. Every player has to belong to a coalition, $\bigcup_{i=1}^{M} C_i = N$, and no player belongs to two coalitions:$C_i \bigcap C_{i'} = \emptyset$. The partition function associates each coalition C_i in a coalition π a worth $v(C_i, \pi)$. Assuming that formed coalitions compete in a noncooperative way, the partition function would be the Nash equilibrium

[5]This is the game Δ in Hart and Kurz (1983).

payoff of the game played by the coalitions. Suppose j belongs to coalition C_i : $j \in C_i$. Let s^* be a vector of strategies, where the strategy set for j is written as $S_j = \{e_j : C_i \to [0, \bar{e}_j]\}$ and strategy $s_j \in S_j$. If for all $C_i \in \pi$ and for all $s_{C_i} \in \times_{j \in C_i} S_j$, $\sum_{j \in C_i} u_j(s^*_{C_i}, s^*_{N/C_i}) \geq \sum_{j \in C_i} u_j(s_{C_i}, s^*_{N/C_i})$, then we can define the partition function as $v(C_i, \pi) = \sum_{j \in C_i} u_j(s^*)$. For convenience, I also denote $v_j(C_i, \pi) = u_j(s^*)$ as the Nash equilibrium payoff of j being in coalition C_i.

In the first stage coalition is formed. There are two coalition s possible : $\pi_1 = \{\{1\}, \{2\}\}$ and $\pi_2 = \{\{1, 2\}\}$. When 1 and 2 decide to compete, it is the same as having two separate movements or two singleton coalitions $\pi_1 = \{\{1\}, \{2\}\}$. When they decide to cooperate, $\pi_2 = \{\{1, 2\}\}$ is formed. In the second stage organizations decide on the optimal effort level given the coalition .

Let's first calculate the partition function for $\pi_1 = \{\{1\}, \{2\}\}$ when organizations remain separate. The maximization problem of organization 1 is:

$$\max_{0 \leq e_1 \leq \bar{e}_1} u_1(e_1, e_2) = P_1 + bP_2 - c_1(e_1). \tag{B.1}$$

Similarly, the maximization problem of organization 2 is:

$$\max_{0 \leq e_2 \leq \bar{e}_2} u_2(e_1, e_2) = bP_1 + P_2 - c_2(e_2). \tag{B.2}$$

Recall that $P_j(e_1, e_2; a_1, a_2)$ is the probability of the actual provision of j. Let's examine 1's maximization problem (B.1). The first term in the right hand side of the equation is the expected payoff of 1 from receiving its own public good 1. The second term is the expected payoff from public good 2 discounted by b. The third term is the cost incurred from putting in an effort level of e_1 to the movement. Solutions of these maximization problems exist[6] and we note them

[6]The objective function u_j is a continuous and concave function and the set of e_j is a nonempty, compact and convex set - we know that solution exists. Refer to theorem 4.1 (Eichberger, 1993, p. 90).

as e_1^* and e_2^*. Corresponding partition functions are $v(\{1\}, \pi_1) = u_1(e_1^*, e_2^*)$, and $v(\{2\}, \pi_1) = u_2(e_1^*, e_2^*)$.

Let's now get the partition function for $\pi_2 = \{\{1, 2\}\}$ when two organizations come together and build a coalition. $v(\{1, 2\}, \pi_2)$ will be the sum of their maximum payoffs, which will be obtained by 1 solving the below maximization problem:

$$\begin{aligned}\max_{0 \le e_1 \le \bar{e}_1} u_1(e_1, e_2) + u_2(e_1 + e_2) =& P_1 + bP_2 - c_1(e_1) \\ &+ bP_1 + P_2 - c_2(e_2). \end{aligned} \tag{B.3}$$

and 2 solving the following maximization problem:

$$\begin{aligned}\max_{0 \le e_2 \le \bar{e}_2} u_2(e_1, e_2) =& P_1 + bP_2 - c_1(e_1) \\ &+ bP_1 + P_2 - c_2(e_2). \end{aligned} \tag{B.4}$$

Here, note that $P_1 = P_2 = 1/2$ since both organizations are in a coalition and the decision maker is indifferent. Let's examine 1's maximization problem (B.3). The first bracket in the right hand side of equation is the expected payoff of organization 1 when exerting e_1 and the second bracket is that of organization 2 when it exerts e_2. Organization 1 maximizes the aggregated expected payoff of both organizations. Solving this maximization problem, we denote the solutions as e_1^{**}, and e_2^{**}. We then get the partition functions as $v(\{1, 2\}, \pi_2) = u_1(e_1^{**}, e_2^{**}) + u_2(e_1^{**}, e_2^{**})$. Here, the payoffs of organization 1 and 2 in belonging in the grand coalition are $v_1(\{1, 2\}, \pi_2) = u_1(e_1^{**}, e_2^{**})$ and $v_1(\{1, 2\}, \pi_2) = u_1(e_1^{**}, e_2^{**})$.

Let's now see what coalitional can be supported as a Nash Equilibrium Outcome. For notational convenience, I omit the coalition that each individual belong to - specifying the coalitional structure will be sufficient. $\pi_1 = \{\{1\}, \{2\}\}$ is

a trivial nash equilibrium outcome: when an organization decides to be independent, the other organization's best response would be to be independent as well. The coalition $\pi_2 = \{\{1,2\}\}$ is a nash equilibrium outcome if and only if $v_2(\pi_2) \geq v_2(\pi_1)$ and $v_1(\pi_2) \geq v_1(\pi_1)$:given that the other wants to cooperate, organization will cooperate only when the payoff is greater in the grand coalition case.[7] In the next subsection I solve for a two organization case with a specific provision function P_j.

B.1.2 Coalition Formation Example

There are two organizations with different political opportunities a_1 and a_2, where $a_1 < a_2$ and $a_1 + a_2 = 1$. They have the same linear cost function $c_1(e) = c_2(e) = ce$ with an overlap of their claims b. At stage 1, organizations build coalition. At stage 2, depending on the coalition formation, they decide on their effort level. Suppose there exists a minimum effort level $e_0 = 1$ in order to participate in a protest. Then the effort that organization j will exert will be $1 + e_j$. When the two groups protest, the probability that good j will be provided by the decision maker is: $P_j(e_1, e_2; a_1, a_2) = \dfrac{(1+e_j)a_j}{(1+e_1)a_1 + (1+e_2)a_2}$, for $j = 1, 2$.[8] For simplicity, let's assume the maximum effort possible in addition to the minimum amount 1 is $\bar{e}_1 = \bar{e}_2 = 1$.

In stage one, organizations simultaneously decide whether to cooperate or to compete. There are two coalition structure possible: $\pi_1 = \{\{1\},\{2\}\}$ and $\pi_2 = \{\{1,2\}\}$. Let's get the partition function for $\pi_1 = \{\{1\},\{2\}\}$. Organization

[7] One can use the Strong Nash Equilibrium concept devised by Aumann (1959) to find out when π_2 dominates π_1.

[8] This can be thought of as there being an effectiveness function $\psi(e_j, a_j) = (e_j + 1)a_j$ and the decision maker linearly weighting the two organizations (Esteban and Ray, 2006). This formulation follows the rent-seeking literature.

1's maximization problem is

$$\max_{0\le e_1\le 1} u_1(e_1,e_2) = \frac{(e_1+1)a_1}{(e_1+1)a_1+(e_2+1)a_2} + b\frac{(e_2+1)a_2}{(e_1+1)a_1+(e_2+1)a_2} - c(e_1+1). \tag{B.5}$$

Organization 2's maximization problem is

$$\max_{0\le e_2\le 1} u_2(e_1,e_2) = \frac{(e_2+1)a_2}{(e_1+1)a_1+(e_2+1)a_2} + b\frac{(e_1+1)a_1}{(e_1+1)a_1+(e_2+1)a_2} - c(e_2+1). \tag{B.6}$$

The solution of the above maximization problem (e_1^*) and (e_2^*) are:

$$e_1^* = e_2^* = \begin{cases} 0, & \text{if } b > 1-\dfrac{c}{a_1a_2}; \\ \dfrac{(1-b)a_1a_2}{c}-1, & \text{if } 1-\dfrac{2c}{a_1a_2} \le b \le 1-\dfrac{c}{a_1a_2}; \\ 1, & \text{if } b < 1-\dfrac{2c}{a_1a_2}. \end{cases}$$

Studying the solution of the maximization problem (B.5), several propositions can be made.

Proposition B.1 *As organization i increases e_i^*, protest j will match it by increasing e_j^*.*

Let's just focus on the interior solutions. When we solve the maximization problem (B.5), we get the first order condition $\dfrac{a_1a_2(e_2^*+1)}{(a_1(e_1^*+1)+a_2(e_2^*+1))^2} = c$. Solving for (B.6), we get $\dfrac{a_1a_2(e_1^*+1)}{(a_1(e_1^*+1)+a_2(e_2^*+1))^2} = c$. Therefore, at the equilibrium, $e_1^* = e_2^*$.

This is consistent with Tarrow's observation (Tarrow, 1989, p. 186) that when there exists an external group or an organization, disruptiveness of protest

events increase. Because of the specific provision rule and the identical cost function we impose in this example, regardless of the value of b both organizations will exert the same amount of effort. As organization 1 increases e_1^* to increase its effectiveness, protest 2 will match it by increasing e_2^*, and vice versa.

Proposition B.2 *There exists $\overline{b}$ and $\underline{b}$ such that (i) $b > \overline{b}$ organizations put in zero extra effort and (ii) $b < \underline{b}$ organizations put in its maximum effort possible.*

When b is sufficiently high, it has no need to put in much effort since even if the other public good is provided it will have a similar effect as if were its own good. When b is sufficiently low, the other's gain hurts the organization's payoff so it is better to exert maximum effort in competing.

Proposition B.3 *As two interests overlap more (b increases), the equilibrium effort level e_1^* and e_2^* both decrease.*

Differentiating e_1^* and e_2^* with respect to b, we get $\frac{\partial e_1^*}{\partial b} = -\frac{a_1 a_2}{c(a_1+a_2)^2} < 0$ and $\frac{\partial e_2^*}{\partial b} = -\frac{a_1 a_2}{c(a_1+a_2)^2} < 0$. Therefore, as two interests overlap more (b increases), the equilibrium effort level e_1^* and e_2^* both decrease. Also, when b decreases, e_1^* and e_2^* both increase. Even if the other public good is provided, it will benefit you more as b increases and there is no need to fight to get your own good.

Proposition B.4 *As the political opportunity of organization 2 (a_2) becomes greater, the optimal effort level e_2^* and e_1^* both decrease.*

Taking a derivative of e_1^* and e_2^* with respect to a_2, we get $\frac{\partial e_1^*}{\partial a_2} = \frac{\partial e_2^*}{\partial a_2} = a_1(1-b)\frac{a_1 - a_2}{c(a_1+a_2)^3} < 0$, for all $a_1 < a_2$. Therefore as the political opportunity

of organization 2 (a_2) becomes greater, the optimal effort level e_2^* and e_1^* both decrease.

When the political opportunity of 2 (that had greater political opportunity than 1 to begin with) increases, it will put less effort than before. What should 1 do then? 1 will also spend less time in participating in the protest since protest 2 has become more effective and the probability of 1 getting its own public good goes down: it is better for organization 1 to save the cost by decreasing the effort.

Proposition B.5 *As the political opportunity of organization* 1 *(a_1) becomes greater, the optimal effort level e_1^* and e_2^* both increase.*

Taking a derivative of e_1^* and e_2^* with respect to a_1, we get $\frac{\partial e_1^*}{\partial a_1} = \frac{\partial e_2^*}{\partial a_1} = a_2(1-b)\frac{a_2 - a_1}{c(a_1+a_2)^3} > 0$, for all $a_1 < a_2$. Therefore as the political opportunity of organization 1 (a_1) becomes greater, the optimal effort level e_2^* and e_1^* both increase.

When the political opportunity of organization 1 (that had less political opportunity than 2 to begin with) increases, it will put more effort than before. The reasoning behind this is that as the support of the claim increases for the less favored organization, it is worthwhile for it to grasp the chance and put more resources into the protest. As organization 1 puts in more resources, organization 2 will put more resources as well to match up.

To calculate the partition function for $\pi_1 = \{\{1\},\{2\}\}$, we plug in e_1^* and e_2^* to

the functions u_1 and u_2.

$$v_1(\pi_1) = u_1(e_1^*) = \begin{cases} -c + b + (1-b)a_1, & \text{if } b > 1 - \dfrac{c}{a_1 a_2}; \\ b + (1-b)(a_1)^2, & \text{if } 1 - \dfrac{2c}{a_1 a_2} \leq b \leq 1 - \dfrac{c}{a_1 a_2}; \\ -2c + b + (1-b)a_1 & \text{if } b < 1 - \dfrac{2c}{a_1 a_2}. \end{cases}$$

$$v_2(\pi_1) = u_2(e_2^*) = \begin{cases} -c + b + (1-b)a_2, & \text{if } b > 1 - \dfrac{c}{a_1 a_2}; \\ +b + (1-b)(a_2)^2, & \text{if } 1 - \dfrac{2c}{a_1 a_2} \leq b \leq 1 - \dfrac{c}{a_1 a_2}; \\ -2c + b + (1-b)a_2 & \text{if } b < 1 - \dfrac{2c}{a_1 a_2}. \end{cases}$$

Now let's get the partition function for $\pi_2 = \{\{1, 2\}\}$. This is when the two organizations come together and build a solidarity protest. Given such coalition, the time e_1 (e_2) organization 1 (2) put into the protest work towards the other public good 2 (1) as well. Given the provision rule we impose, the decision maker will provide the goods with the same probability: $P_1 = P_2 = 1/2$ for all e_1, e_2, and a_1 and a_2. 1 chooses $0 \leq e_1 \leq 1$ to maximize the utility:

$$\begin{aligned} \max_{0 \leq e_1 \leq 1} u_1(e_1) + u_2(e_2) &= P_1 + bP_2 - c_1(e_1) \\ &\quad + bP_1 + P_2 - c_2(e_2) \\ &= 1 + b - c(e_1 + 1) - c_2(e_2) \end{aligned} \tag{B.7}$$

And 2 chooses $0 \leq e_2 \leq 1$ to maximize the utility:

$$\begin{aligned} \max_{0 \leq e_2 \leq 1} u_1(e_1) + u_2(e_2) &= P_1 + bP_2 - c_1(e_1) \\ &\quad + bP_1 + P_2 - c_2(e_2) \\ &= 1 + b - c(e_1 + 1) - c_2(e_2). \end{aligned} \tag{B.8}$$

Solving this optimization problem we see that the extra effort $e_1^{**} = e_2^{**} = 0$. This is because $\dfrac{1}{2}$ of probability of provision is guaranteed given that there are only

two organizations and both are cooperating. The partition function becomes $v(\{1,2\},\pi_2) = u_1(e_1^{**},e_2^{**}) + u_2(e_1^{**},e_2^{**}) = 1 + b - 2c$, for all overlap b and political opportunities a_1 and a_2.

Comparing the partition functions it is possible to determine when each coalition structure can be supported as a nash equilibrium. π_1 is a trivial equilibrium outcome since when one organization declares a singleton coalition the best response of the other organization will be also declaring a singleton coalition.

Proposition B.6 *There exist $\widetilde{a}$, $\widehat{a}$, $\widetilde{b}$, and $\widehat{b}$ such that for $\widetilde{a_2} \leq a \leq \widehat{a}$ and for $\widetilde{b} \leq b \leq \widehat{b}$ the grand coalition is supported as a nash equilibrium.*

First, comparing $v_1(\pi_2)$ and $v_1(\pi_1)$, one can see that 1 will always prefer coalition π_2 (the grand coalition) regardless of a_1, a_2, and b (as long as $a_2 > a_1$). 2, however, will want to be in the grand coalition if and only if $a_2 \leq \frac{\sqrt{5}+1}{2}a_1$ and $(-\frac{1}{2} - c + (\frac{a_2}{a_1+a_2}))(-\frac{1}{2} + (\frac{a_2}{a_1+a_2}))^{-1} \leq b \leq 1 - 2c(a_1+a_2)^2({a_2}^2 - 2a_1a_2 - {a_1}^2)^{-1}$. When such conditions do not hold, π_1 will be the only coalition structure arising.

In other words, π_2 can be supported as a nash equilibrium outcome if and only if $a_1 \leq a_2 \leq \frac{\sqrt{5}+1}{2}a_1$ and $(-\frac{1}{2}-c+(\frac{a_2}{a_1+a_2}))(-\frac{1}{2}+(\frac{a_2}{a_1+a_2}))^{-1} \leq b \leq 1-2c(a_1+a_2)^2({a_2}^2 - 2a_1a_2 - {a_1}^2)^{-1}$. Only when the political opportunity of organization 1 is comparable, and when the overlap b is not too low or not too high, cooperation will occur. When b is too low ($b < \widetilde{b}$), the saved resources from not having to compete does not make up for the loss incurred by having to tolerate the materialization of the goals of the other group. When the overlap is high enough ($b > \widehat{b}$), the cost of coalition - the compromise of one's own goals - is greater than the benefit of coalition - the saved resources from not having to compete.

This is because with b so high, organizations will not be exerting much effort in competing with one another in the first place.

Proposition B.7 *The range of b that results in the grand coalition depends on a_1 and a_2. More specifically, as a_2 goes up, the lower bound $\widetilde{b}$ for the grand coalition goes up and the upper bound $\widehat{b}$ goes down.*

Here, taking a derivative of $\widetilde{b}$ and $\widehat{b}$ with respective to a_2, $\frac{\partial \widetilde{b}}{\partial a_2} = c(-\frac{1}{2} + (\frac{a_2}{a_1 + a_2}))^{-2} > 0$ and $\frac{\partial \widehat{b}}{\partial a_2} = -16c(a_1 + a_2)a_1a_2(a_2^2 - 2a_1a_2 - a_1^2)^{-2} < 0$. As a_2 goes up, the lower bound $\widetilde{b}$ for the grand coalition goes up and the upper bound $\widehat{b}$ goes down.

The range of claims overlap that allows for coalition to form is a function of the political opportunities for both organizations. As 2's political opportunity increases, the set of bs will contract and a coalition will be less likely to form.

In B.3, I provide an extension of the model with three players. Through a simplified example, I demonstrate that when there are three organizations 1, 2, 3, with different political opportunities and claims, despite 2's closeness to 1 in policy position, 2 may prefer to build coalition with 3 rather than 1 if 3 has a greater political opportunity than 1.

B.2 Discussion - The Two Labor Unions Case

NLU and EGLU protested against the E-land group, a firm infamous for its oppression against union activities. The unions represented distinct groups of people with specific and different claims. For EGLU, the focus of the strike was

on non-regular employment, demanding the rehiring of the fired workers in the first and second quarters of 2007 and employment guarantee of non-regular workers of 18 months or more. For NLU, regular worker issues were its immediate concerns. In December 2006, after introducing the PDA (personal digital assistant) system in the cash register area, the firm transferred cashiers with regular contracts to other sections or branches (which would require relocation) without the union's consent and started to outsource those jobs. Rumors about selling the most profitable Kang-nam branch of Newcore was another point of dispute. This meant that over a thousand workers would inevitably face restructuring.

Despite the diverging claims (captured by the parameter "$b < 1$"), the different levels of political opportunities or issue salience "a" faced by each union encouraged the coalition to form. The E-land Group was unwilling to relent on the demands of both organizations, which induced the strikers to turn to external support to force the firm out to the negotiation table. The extent of public support for each union can be conceptualized as political opportunity or issue salience.

With the passage of the Non-regular Workers Protection Act and its membership based on the socially neglected, the EGLU drew great attention and sympathy from the public. Having a less salient agenda, $a_{NLU} < a_{EGLU}$, NLU had an incentive to work with the EGLU. By framing its goals in terms of non-regular workers issues and forming a coalition with EGLU that was gaining leverage, the NLU no longer had to exert extraneous effort in attracting public's support. NLU, mostly consisted of young regular workers with better working conditions than the non-regulars, benefited from such identity and claims

alignment.

On the other hand, EGLU had agreed to join forces with the NLU because there was a certain level of commonality between their claims (b was big enough). Moreover, the difference in the level of political opportunities was not as significant once the NLU framed their issues in line with the EGLU. If they stay independent, in case of comparable political opportunities, each has to put in resources to compete over public support in order to achieve their goals. Such rent seeking behavior was demonstrated in proposition B.5. By forming a coalition they could concentrate on fighting against the opponent - the E-land Group - rather than with each other.

Once the negotiations began, however, public support played a lesser role in the progression. The firm explicitly favored NLU over EGLU because it was cheaper in the long run for them to court the regular workers. Moreover, The overlap of claims shrank as well when NLU started to compromise their initial positions on non-regular issues and focused more on regular ones. Even though their claims no longer overlapped much, as a less favored union EGLU wanted to work together with the NLU. Not surprisingly, NLU declined. Note here that I have not made use of the differences in cost structure or transfer of resources in predicting the coalition patterns. The outcomes of this model are robust to such specifications.

B.3 Three Organization Coalition Example

Now we add in one more SMO into the framework. There are three SMOs, 1, 2, and 3, with different levels of political opportunities $a_1 \leq a_2 \leq a_3$ and

cost functions $c_1(e_1)$, $c_2(e_2)$, and $c_3(e_3)$. Again, cost function $c_j(e_j)$ are convex functions of effort e_j that organization j puts in. For simplification of the analysis, let's suppose $a_1 = 0$, $a_2 = a_2$, and $a_3 = 1$ and cost functions are identical, $c_1(e) = c_2(e) = c_3(e) = ce$.

Let's suppose the overlap of claims of group 1 and 2 is $b_{12} = b_{21}$, 2 and 3, $b_{23} = b_{32}$, 3 and 1, $b_{31} = b_{13}$.[9] For this exercise I assume that $b_{23} = b_{32} = b_{31} = b_{13} = d$, $b_{12} = b_{21} = b$, and $b > d$. That is, organization 1 and 2 has overlap of claims of b, when 1 and 3, and 2 and 3 has overlap of d: The two weaker organizations have more commonality with each other than with the strongest organization.

As the previous example, I suppose that the minimum effort level to participate in the movement is 1. The effort that organization j will exert then will be $1 + e_j$. I also assume that the maximum extra effort j can put in is 1. The government provides each public good weighting the combination of political opportunity and the effort as follows: $P_j(e_1, e_2, e_3; a_1, a_2, a_3) = \frac{(1 + e_j)a_j}{\sum_{j=1}^{3}(1 + e_j)a_j}$. When two or three organizations build coalition, the new political opportunity becomes identical with the greatest political opportunity in the coalition C: $a_c = max(a_{j \in C})$.

Possible coalitional structures that can form at Stage 1 are as follows: $\pi_1 = \{\{1\}, \{2\}, \{3\}\}$, $\pi_2 = \{\{1, 2\}, \{3\}\}$, $\pi_3 = \{\{2, 3\}, \{1\}\}$, $\pi_4 = \{\{3, 1\}, \{2\}\}$, and $\pi_5 = \{\{1, 2, 3\}\}$. At stage two, given the coalitional structure, organization j, where $j = 1, 2, 3$, decides how much effort - e_j - to put in to the movement. The characteristic function v is associated with each coalition is written as $v(C_i, \pi)$, where C_i is a coalition in the coalition structure π. As before, for notational convenience, I

[9]Having the extent of overlap as three independent parameters can be justified. Suppose there are three organizations: a pro-choice group, a women's rights group, and a civil rights group. Then pro-choice and women's rights have an overlap, and civil rights and women's rights have an overlap but pro-choice and civil rights does not have an overlap.

write payoff of $j \in C_i$ that belongs to π, as $v_j(\pi)$.

Rather than solving for nash equilibria outcome for all cases, let's focus on a specific question: when will the two weak organizations (1 and 2) that have a greater overlap of claims build coalition against the more effective organization (3) and when will one of the two build coalition with 3?[10] That is, in what situations is $\pi_3 = \{\{2,3\},\{1\}\}$ or $\pi_4 = \{\{3,1\},\{2\}\}$ more likely to occur than $\pi_2 = \{\{1,2\},\{3\}\}$?

Let's first compare between coalition structures $\pi_3 = \{\{2,3\},\{1\}\}$ and $\pi_4 = \{\{3,1\},\{2\}\}$.[11]

Proposition B.8 *If π_3 and π_4 both are nash equilibrium outcomes, $\pi_3 = \{\{2,3\},\{1\}\}$ will be always preferred to $\pi_4 = \{\{3,1\},\{2\}\}$ by 3.*

For 3, organizations 1 and 2 can be distinguished only by their political opportunities since the claims difference is equally d. 3 will get a half of $v(\{2,3\},\pi_3)$ or $v(\{3,1\},\pi_4)$ and it will prefer the coalition that results in a higher pay-off. Since 1's political opportunity is lower than 2, competing against 1 will yield a higher payoff than competing against 2. Therefore it will prefer π_3 over π_4 in any case.

Now let's compare coalition structures π_2 and π_3.

Proposition B.9 *If π_2 and π_3 are nash equilibrium outcomes, for a sufficiently high a_2 and for a range of $\underline{d} < d < \bar{d}$, 3 will want to build coalition with 2 and therefore prefer π_2 over π_3.*

[10] Since we are controlling for the cost function an organization with a higher political opportunity structure will be more effective.

[11] Remember that this is an exclusive membership game where coalition is built only when all the members within it agree.

From the point of view of 3, choosing between π_2 and π_3 will be similar to choosing cooperation or competition with 2 in a two player situation. To 3, coalition of 1 and 2 is basically identical to 2. Even though it will be competing against a joint effort by 1 and 2, this will be undistinguishable from the case when it competes against 2 only: the claims difference of 3 and 1 and 3 and 2 are equally d and 1 and 2 have the same cost structure and political opportunity a_2 once in the coalition $\{1, 2\}$. Given that we have assumed a_1 to be equal to zero, for coalition structure π_3, the probability that 1 will get its public good is equal to zero. Then the government will simply randomize between the public good 2 and 3 and this is the same as the example 1's two player grand coalition case where there are only two players. So as we have calculated in example 1, for a very high d or for a very low d, 3 will want to compete against the coalition $\{1, 2\}$. That is, for a sufficiently high a_2 and for a range of $\underline{d} < d < \bar{d}$, 3 will want to build coalition with 2 and therefore prefer π_2 over π_3.

How about for organization 2?

Proposition B.10 *If π_2 and π_3 are nash equilibrium outcomes, for all $b < 1$ and $a_2 < 1$, 2 will prefer π_3 over π_2.*

When 2 is in the coalition $\{2, 3\}$, with $1/2$ probability public good 2 will be provided and with $1/2$ probability public good 3 will be provided. Since the cost incurred would be $-c$, 2's payoff will be $1/2 + 1/2d - c$. When in the coalition $\{1, 2\}$ and competing against 3, the maximum payoff organization 2 can obtain is $1/2 + 1/2d - c$ when $b = 1$ and $a_2 = 1$. For all $b < 1$ and $a_2 < 1$ then, it will be better off being in the coalition $\{2, 3\}$ than $\{1, 2\}$.

In sum, despite 2's closeness to 1 in policy position, 2 will prefer to build

coalition with 3 rather than 1 because 3 has a greater political opportunity than 1 which compensates for the differences in the claims. Therefore a coalition of 2 and 3 will arise rather than a coalition of 1 and 2 if and only if a_2 is comparable to a_3 and the overlap between 2 and 3 is within a certain range.

APPENDIX C

APPENDIX TO CHAPTER 3

C.1 Derivations of Results in Table 3.2

C.1.1 Case 1

$$0 < z < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{w_h + \hat{w}_l}{2}$$

In this case, $\hat{w}_l$ and $\hat{w}_h$ are sufficiently high relative to z that only the households with both individuals unemployed are poor. The value of P_α in this case is

$$\begin{aligned} P_\alpha &= (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2(\frac{z - 0}{z})^\alpha \\ &= (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2. \end{aligned} \tag{C.1}$$

Let us now see how P_α is affected by an increase in $\hat{w}_l$. We have

$$\frac{dP_\alpha}{d\hat{w}_l} = 2(1 - x_h)(1 - \frac{x_l}{2 - x_h})(-\frac{1}{2 - x_h})\frac{dx_l}{d\hat{w}_l}. \tag{C.2}$$

For a standard labor demand function with $\frac{dx_l}{d\hat{w}_l} < 0$, this expression is always positive. That is, poverty always increases as the minimum wage increases. Furthermore, if we assume a constant elasticity of labor demand $\eta = -\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l} > 0$, it can be manipulated to produce

$$\begin{aligned} \frac{\hat{w}_l}{x_l}\frac{dP_\alpha}{d\hat{w}_l} &= 2(1 - x_h)(1 - \frac{x_l}{2 - x_h})(-\frac{1}{2 - x_h})\frac{dx_l}{d\hat{w}_l}\frac{\hat{w}_l}{x_l} \\ &= 2(1 - x_h)(1 - \frac{x_l}{2 - x_h})(\frac{1}{2 - x_h})\eta, \end{aligned} \tag{C.3}$$

where it is apparent that $\frac{dP_\alpha}{d\hat{w}_l} > 0$ if and only if $\eta > 0$ for all α.

C.1.2 Case 2

$$0 < \frac{\hat{w}_l}{2} < z < \frac{w_h}{2} < \hat{w}_l < \frac{w_h + \hat{w}_l}{2}$$

In Case 2, the poor households are those where both individuals are unemployed or where only one household member is employed and that person earns the minimum wage. In this case,

$$P_\alpha = (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2 + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha. \tag{C.4}$$

The effect of a higher minimum wage is

$$\begin{aligned}\frac{dP_\alpha}{d\hat{w}_l} &= 2(1 - x_h)(\frac{1}{2 - x_h})[(1 - \frac{x_l}{2 - x_h})(-1 + (1 - \frac{\hat{w}_l}{2z})^\alpha) \\ &\quad - (\frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha]\frac{dx_l}{d\hat{w}_l} \\ &\quad + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})\alpha(1 - \frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}).\end{aligned} \tag{C.5}$$

If we assume a constant elasticity of labor demand as before:

$$\begin{aligned}\frac{\hat{w}_l}{x_l}\frac{dP_\alpha}{d\hat{w}_l} &= 2(1 - x_h)(\frac{1}{2 - x_h})[(1 - \frac{x_l}{2 - x_h})(-1 + (1 - \frac{\hat{w}_l}{2z})^\alpha) \\ &\quad - (\frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha]\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l} \\ &\quad + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})\alpha(1 - \frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z})\frac{\hat{w}_l}{x_l},\end{aligned} \tag{C.6}$$

which can be manipulated to yield

$$\begin{aligned}\frac{dP_\alpha}{d\hat{w}_l} &= 2(1 - x_h)(\frac{1}{2 - x_h})[(1 - \frac{x_l}{2 - x_h})(1 - (1 - \frac{\hat{w}_l}{2z})^\alpha) \\ &\quad + (\frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha]\eta(\frac{\hat{w}_l}{x_l})^{-1} \\ &\quad + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})\alpha(1 - \frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}).\end{aligned} \tag{C.7}$$

The first term of (C.7) can be thought of as the unemployment effect; it tells us how an increase in the minimum wage brings about a reduction in employment. The expression in brackets in the first term $[(1 - \frac{x_l}{2 - x_h})(1 - (1 - \frac{\hat{w}_l}{2z})^\alpha) +$

$(\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^{\alpha}]$ is always positive since $0 \leq (1-(1-\frac{\hat{w}_l}{2z})^{\alpha}) \leq 1$ for all α. This term is multiplied by a number of positive terms, which proves that the entire first expression is always positive. The second term can be thought of as the earnings effect; it tells us how an increase in the minimum wage affects P_α via the gain in earnings for those employed. To sign this expression, note that in Case 2, $\frac{\hat{w}_l}{2} < z$, hence $1-\frac{\hat{w}_l}{2z} > 0$, and therefore all terms are positive except for $-\frac{1}{2z}$. The product of these terms is therefore negative.

To analyze the sign of $\frac{dP_\alpha}{d\hat{w}_l}$ let us deal now with some particular values of α. First, it may be shown that when $\alpha = 0$, for any η, $\frac{dP_\alpha}{d\hat{w}_l} > 0$. Then the expression becomes $\frac{dP_0}{d\hat{w}_l} = 2(1-x_h)(\frac{1}{2-x_h})(\frac{x_l}{2-x_h})\eta(\frac{\hat{w}_l}{x_l})^{-1}$, which is positive for any positive η. It may also be shown that when $\alpha \geq 1$, $\frac{dP_\alpha}{d\hat{w}_l} \geq (<)0$ if and only if

$$\eta \geqslant (<)\frac{(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(\frac{1}{2z})\hat{w}_l}{[(1-\frac{x_l}{2-x_h})+(\frac{2x_l}{2-x_h}-1)(1-\frac{\hat{w}_l}{2z})^{\alpha}]}.$$

C.1.3 Case 3

$$0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < z \leqslant \hat{w}_l < \frac{w_h+\hat{w}_l}{2}$$

In this case, the poverty group consists of households in which both individuals are unemployed and those in which only one household member is employed regardless of the sector of employment. The extent of poverty in this case is given by

$$\begin{aligned} P_\alpha = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^{\alpha} \\ & + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^{\alpha}. \end{aligned} \tag{C.8}$$

Differentiating this with respect to the level of the minimum wage yields

$$\begin{aligned}\frac{dP_\alpha}{dw_l} &= 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l} \\ &+ 2(1-x_h)(\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}) \\ &+ (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha. \end{aligned} \tag{C.9}$$

If the labor demand elasticity η is assumed to be constant, equation (8) can be further manipulated to yield a condition in terms of η:

$$\begin{aligned}\frac{\hat{w}_l}{x_l}\frac{dP_\alpha}{dw_l} &= 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l} \\ &+ 2(1-x_h)(\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}\frac{\hat{w}_l}{x_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z})\frac{\hat{w}_l}{x_l} \\ &+ (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha\frac{\hat{w}_l}{x_l}, \end{aligned} \tag{C.10}$$

which in turn produces

$$\begin{aligned}\frac{dP_\alpha}{dw_l} &= \eta[2(1-x_h)(1-\frac{x_l}{2-x_h})(\frac{1}{2-x_h}) - 2(1-x_h)(\frac{1}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h)(\frac{1}{2-x_h})(\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ (\frac{1}{2-x_h})x_h(1-\frac{w_h}{2z})^\alpha](\frac{\hat{w}_l}{x_l})^{-1} \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}). \end{aligned} \tag{C.11}$$

Again, the first term is the unemployment effect (which is always positive), and the second term is the earnings effect (which is always negative). Let us look at particular values of α. It can be verified that when $\alpha = 0$, for any η, $\frac{dP_\alpha}{dw_l} >$

0. When $\alpha \geq 1$, $\frac{dP_\alpha}{dw_l} \geq (<)0$ if and only if $\eta \geq (<)[(1-x_h)(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(\frac{\hat{w}_l}{z})][2(1-x_h)(1-\frac{x_l}{2-x_h})-2(1-x_h)(1-\frac{2x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha+x_h(1-\frac{w_h}{2z})^\alpha]^{-1}$.

C.1.4 Case 4

$$0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < z \leqslant \frac{w_h + \hat{w}_l}{2}$$

In Case 4, households in which both individuals are unemployed and in which only one household member is employed are below the poverty line. Moreover, if both household members are employed and earn the minimum wage, that household falls below the poverty line.

On the other hand, a household with a high wage earner and a low wage earner is above the poverty line. This could be a possible stylization of the US labor market where about 80% of minimum wage earners live with a high wage earner (Burkhauser et al., 2000). The poverty measure in this case becomes:

$$\begin{aligned} P_\alpha = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ & + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha. \end{aligned} \tag{C.12}$$

Differentiating the above expression with respect to w_l to get the effect on P_α of

increase in w_l,

$$\begin{aligned}
\frac{dP_\alpha}{dw_l} &= 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l} \\
&+ 2(1-x_h)(\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}) \\
&+ (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha \\
&+ 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})\frac{dx_l}{dw_l}(1-\frac{\hat{w}_l}{z})^\alpha \\
&+ (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z}).
\end{aligned} \tag{C.13}$$

If the labor demand elasticity η is assumed to be constant, it can be rewritten as:

$$\begin{aligned}
\frac{\hat{w}_l}{x_l}\frac{dP_\alpha}{dw_l} &= 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l} \\
&+ 2(1-x_h)(\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}\frac{\hat{w}_l}{x_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z})\frac{\hat{w}_l}{x_l} \\
&+ (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha\frac{\hat{w}_l}{x_l} \\
&+ 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})\frac{dx_l}{dw_l}(1-\frac{\hat{w}_l}{z})^\alpha\frac{\hat{w}_l}{x_l} \\
&+ (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z})\frac{\hat{w}_l}{x_l},
\end{aligned} \tag{C.14}$$

which can be expressed as:

$$\begin{aligned}\frac{dP_\alpha}{dw_l} = \eta[&2(1-x_h)(1-\frac{x_l}{2-x_h})(\frac{1}{2-x_h}) - 2(1-x_h)(\frac{1}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(\frac{1}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + (\frac{1}{2-x_h})x_h(1-\frac{w_h}{2z})^\alpha \\ &- 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})(1-\frac{\hat{w}_l}{z})^\alpha](\frac{\hat{w}_l}{x_l})^{-1} \\ &+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}) \\ &+ (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z}). \end{aligned} \tag{C.15}$$

Again, the first term on the right hand side is the unemployment effect. which can be shown to be always positive. (Group the first two terms in brackets together and the third and fifth terms together, from which we can see that the bracketed term is always positive.) The rest of the terms of the equation form the earnings effect, which is always negative. Looking at different values of α, when $\alpha = 0$, for any η, $\frac{dP_\alpha}{dw_l} > 0$. When $\alpha \geq 1$, it may be shown that $\frac{dP_\alpha}{dw_l} \geq (<)0$ if and only if $\eta \geq (<)[(1-x_h)(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(\frac{\hat{w}_l}{z}) + (1-x_h)(\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(\frac{\hat{w}_l}{z})][2(1-x_h)(1-\frac{x_l}{2-x_h}) - 2(1-x_h)(1-\frac{2x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{w_h}{2z})^\alpha - 2(1-x_h)\frac{x_l}{2-x_h}(1-\frac{\hat{w}_l}{z})^\alpha]^{-1}$.

C.1.5 Case 5

$$0 < \frac{\hat{w}_l}{2} < \frac{w_h}{2} < \hat{w}_l < \frac{w_h + \hat{w}_l}{2} < z$$

For Case 5, all households fall below the poverty line regardless of the employment status of the household members. The poverty measure can be expressed

in this case as:

$$
\begin{aligned}
P_\alpha = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
& + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha \\
& + x_h\frac{x_l}{2-x_h}(1-\frac{\hat{w}_l+w_h}{2z})^\alpha. \qquad \text{(C.16)}
\end{aligned}
$$

Differentiating this expression with respect to $\hat{w}_l$ yields

$$
\begin{aligned}
\frac{dP_\alpha}{dw_l} = {} & 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l} \\
& + 2(1-x_h)(\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
& + 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\
& + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}) \\
& + (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha \\
& + 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})\frac{dx_l}{dw_l}(1-\frac{\hat{w}_l}{z})^\alpha \\
& + (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z}) \\
& + x_h\frac{1}{2-x_h}\frac{dx_l}{dw_l}(1-\frac{\hat{w}_l+w_h}{2z})^\alpha \\
& + x_h\frac{x_l}{2-x_h}\alpha(1-\frac{\hat{w}_l+w_h}{2z})^{\alpha-1}(-\frac{1}{2z}). \qquad \text{(C.17)}
\end{aligned}
$$

If the elasticity of labor demand is assumed constant, the previous expression

can be rewritten as:

$$\begin{aligned}
\frac{\hat{w}_l}{x_l}\frac{dP_\alpha}{dw_l} &= 2(1-x_h)(1-\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l} \\
&+ 2(1-x_h)(\frac{1}{2-x_h})\frac{\hat{w}_l}{x_l}\frac{dx_l}{d\hat{w}_l}(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(-\frac{1}{2-x_h})\frac{dx_l}{d\hat{w}_l}\frac{\hat{w}_l}{x_l}(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z})\frac{\hat{w}_l}{x_l} \\
&+ (-\frac{1}{2-x_h})x_h\frac{dx_l}{dw_l}(1-\frac{w_h}{2z})^\alpha\frac{\hat{w}_l}{x_l} \\
&+ 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})\frac{dx_l}{dw_l}(1-\frac{\hat{w}_l}{z})^\alpha\frac{\hat{w}_l}{x_l} \\
&+ (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z})\frac{\hat{w}_l}{x_l} \\
&+ x_h\frac{1}{2-x_h}\frac{dx_l}{dw_l}\frac{\hat{w}_l}{x_l}(1-\frac{\hat{w}_l+w_h}{2z})^\alpha \\
&+ x_h\frac{x_l}{2-x_h}\alpha(1-\frac{\hat{w}_l+w_h}{2z})^{\alpha-1}(-\frac{1}{2z})\frac{\hat{w}_l}{x_l}, \qquad \text{(C.18)}
\end{aligned}$$

which in turn can be rewritten as

$$\begin{aligned}
\frac{dP_\alpha}{dw_l} &= \eta[2(1-x_h)(1-\frac{x_l}{2-x_h})(\frac{1}{2-x_h}) - 2(1-x_h)(\frac{1}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(\frac{1}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\
&- 2(1-x_h)\frac{x_l}{2-x_h}(\frac{1}{2-x_h})(1-\frac{\hat{w}_l}{z})^\alpha \\
&+ (\frac{1}{2-x_h})x_h(1-\frac{w_h}{2z})^\alpha - x_h\frac{1}{2-x_h}(1-\frac{\hat{w}_l+w_h}{2z})^\alpha(\frac{\hat{w}_l}{x_l})^{-1} \\
&+ 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(-\frac{1}{2z}) \\
&+ (1-x_h)(\frac{x_l}{2-x_h})^2\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(-\frac{1}{z}) \\
&+ x_h\frac{x_l}{2-x_h}\alpha(1-\frac{\hat{w}_l+w_h}{2z})^{\alpha-1}(-\frac{1}{2z}). \qquad \text{(C.19)}
\end{aligned}$$

Again, we have the unemployment effect (always positive) in the first term of the right hand side of the equation and the earnings effect (always negative) in the rest of the equation. Analyzing this for specific values of α, when $\alpha = 0$, for

any η, $\frac{dP_\alpha}{dw_l} = 0$. This is because everyone is under the poverty line, and that does not change as $\hat{w}_l$ increases. When $\alpha = 1$, it is straightforward to show that for $\eta \geq (<)1$, $\frac{dP_\alpha}{dw_l} \geq (<)0$. Finally, for $\alpha > 1$, we have the condition that: $\frac{dP_\alpha}{dw_l} \geq (<)0$ if and only if $\eta \geq (<)[(1-x_h)(1-\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{2z})^{\alpha-1}(\frac{\hat{w}_l}{z}) + (1-x_h)(\frac{x_l}{2-x_h})\alpha(1-\frac{\hat{w}_l}{z})^{\alpha-1}(\frac{\hat{w}_l}{z}) + x_h\alpha(1-\frac{\hat{w}_l+w_h}{2z})^{\alpha-1}(\frac{\hat{w}_l}{2z})][2(1-x_h)(1-\frac{x_l}{2-x_h}) - 2(1-x_h)(1-\frac{2x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{w_h}{2z})^\alpha - 2(1-x_h)\frac{x_l}{2-x_h}(1-\frac{\hat{w}_l}{z})^\alpha - x_h(1-\frac{\hat{w}_l+w_h}{2z})^\alpha]^{-1}$.

C.2 Proofs for Propositions

C.2.1 Proposition 3.1

a) From (C.7), $\frac{dP_\alpha}{d\hat{w}_l} > 0$ within Case 2.
b) From (C.2), $\frac{dP_\alpha}{d\hat{w}_l} > 0$ within Case 1.
c) The boundary between Cases 2 and 1 occurs at $\hat{w}_l = 2z$. From (C.4), $P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})\alpha$ in Case 2; from (C.1), $P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2$ in Case 1.

Evaluated at $\hat{w}_l = 2z$ and setting $\alpha = 0$,

$$P_0 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h}) \tag{C.20}$$

in Case 2 and

$$P_0 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 \tag{C.21}$$

in Case 1. Because (C.20) > (C.21), P_0 falls discontinuously at $\hat{w}_l = 2z$. Combining results a-c), Proposition 3.1 is proved.

C.2.2 Proposition 3.2

a) From (C.19), $\frac{dP_\alpha}{d\hat{w}_l} = 0$ within Case 5.
b) From (C.15), $\frac{dP_\alpha}{d\hat{w}_l} > 0$ within Case 4.
c) From (C.11), $\frac{dP_\alpha}{d\hat{w}_l} > 0$ within Case 3.
d) The boundary between Cases 5 and 4 occurs at $\hat{w}_l = 2z - \hat{w}_h$ From (C.16),

$$\begin{aligned} P_\alpha = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ & + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha \\ & + x_h\frac{x_l}{2-x_h}(1-\frac{\hat{w}_l+w_h}{2z})^\alpha \end{aligned} \tag{C.22}$$

in Case 5; from (C.12),

$$\begin{aligned} P_\alpha = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \\ & + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha \end{aligned} \tag{C.23}$$

in Case 4. Evaluated at $\hat{w}_l = 2z - \hat{w}_h$ and setting $\alpha = 0$,

$$\begin{aligned} P_0 = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h}) + x_h(1-\frac{x_l}{2-x_h}) \\ & + (1-x_h)(\frac{x_l}{2-x_h})^2 + x_h\frac{x_l}{2-x_h} \end{aligned} \tag{C.24}$$

in Case 5 and

$$\begin{aligned} P_0 = {} & (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h}) + x_h(1-\frac{x_l}{2-x_h}) \\ & + (1-x_h)(\frac{x_l}{2-x_h})^2 \end{aligned} \tag{C.25}$$

in Case 4. Because (C.24) > (C.15), P_0 falls discontinuously at $\hat{w}_l = 2z - \hat{w}_h$.

e) The boundary between Cases 4 and 3 occurs at $\hat{w}_l = z$. From (C.12),

$$P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha \quad \text{(C.26)}$$

in Case 4. From (C.8),

$$P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha \quad \text{(C.27)}$$

in Case 3.

Evaluated at $\hat{w}_l = z$ and setting $\alpha = 0$,

$$P_0 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h}) + x_h(1-\frac{x_l}{2-x_h}) + (1-x_h)(\frac{x_l}{2-x_h})^2 \quad \text{(C.28)}$$

in Case 4 and

$$P_0 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h}) + x_h(1-\frac{x_l}{2-x_h}) \quad \text{(C.29)}$$

in Case 3. Because (C.28) > (C.29), P_0 falls discontinuously at $\hat{w}_l = 2z - \hat{w}_h$. Combining results a-e), Proposition 3.2 is proved.

C.2.3 Proposition 3.3

Proof for $z < \frac{w_h}{2}$:

The continuity of P_2 within each case is evident. As for the boundary, the dividing line between Cases 2 and 1 occurs at $\hat{w}_l = 2z$. From (C.4),

$$P_2 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha \quad \text{(C.30)}$$

in Case 2; from (C.1),

$$P_2 = (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2 \tag{C.31}$$

in Case 1. Evaluated at $\hat{w}_l = 2z$, $P_2 = (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2$ in Case 2, which is identical to what P_2 equals in Case 1 at that point. Continuity is thereby proved.

C.2.4 Proposition 3.4

Proof for $z > \frac{w_h}{2}$:

a-c) The continuity of P_2 within each case follows exactly as in C.2 a-c).

d) The boundary between Cases 5 and 4 occurs at $\hat{w}_l = 2z - \hat{w}_h$. From (C.16),

$$\begin{aligned} P_\alpha = {} & (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2 + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha \\ & + x_h(1 - \frac{x_l}{2 - x_h})(1 - \frac{w_h}{2z})^\alpha + (1 - x_h)(\frac{x_l}{2 - x_h})^2(1 - \frac{\hat{w}_l}{z})^\alpha \\ & + x_h \frac{x_l}{2 - x_h}(1 - \frac{\hat{w}_l + w_h}{2z})^\alpha \end{aligned} \tag{C.32}$$

in Case 5; From (C.12),

$$\begin{aligned} P_\alpha = {} & (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2 + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})(1 - \frac{\hat{w}_l}{2z})^\alpha \\ & + x_h(1 - \frac{x_l}{2 - x_h})(1 - \frac{w_h}{2z})^\alpha + (1 - x_h)(\frac{x_l}{2 - x_h})^2(1 - \frac{\hat{w}_l}{z})^\alpha \end{aligned} \tag{C.33}$$

in Case 4.

Evaluated at $\hat{w}_l = 2z - \hat{w}_h$ and setting $\alpha = 2$,

$$\begin{aligned} P_2 = {} & (1 - x_h)(1 - \frac{x_l}{2 - x_h})^2 + 2(1 - x_h)(\frac{x_l}{2 - x_h})(1 - \frac{x_l}{2 - x_h})(1 - \frac{2z - w_h}{2z})^2 \\ & + x_h(1 - \frac{x_l}{2 - x_h})(1 - \frac{w_h}{2z})^2 + (1 - x_h)(\frac{x_l}{2 - x_h})^2(1 - \frac{2z - w_h}{z})^2 \end{aligned} \tag{C.34}$$

in Case 5 and

$$P_2 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{2z-w_h}{2z})^2 + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^2 + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{2z-w_h}{z})^2 \quad \text{(C.35)}$$

in Case 4. These are identical, and therefore P_2 is continuous at the boundary between Cases 5 and 4.

e) The boundary between Cases 4 and 3 occurs at $\hat{w}_l = z$. From (C.12),

$$P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha + (1-x_h)(\frac{x_l}{2-x_h})^2(1-\frac{\hat{w}_l}{z})^\alpha \quad \text{(C.36)}$$

in Case 4; from (C.8),

$$P_\alpha = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(1-\frac{\hat{w}_l}{2z})^\alpha + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^\alpha \quad \text{(C.37)}$$

in Case 3.

Evaluated at $\hat{w}_l = z$ and setting $\alpha = 2$,

$$P_2 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(\frac{1}{2})^2 + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^2 \quad \text{(C.38)}$$

Case 4 and

$$P_2 = (1-x_h)(1-\frac{x_l}{2-x_h})^2 + 2(1-x_h)(\frac{x_l}{2-x_h})(1-\frac{x_l}{2-x_h})(\frac{1}{2})^2 + x_h(1-\frac{x_l}{2-x_h})(1-\frac{w_h}{2z})^2 \quad \text{(C.39)}$$

in Case 3. These are identical, and therefore P_2 is continuous at the boundary between Cases 4 and 3. Combining results a-e), Proposition 3.4 is proved.

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